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VIEWS, NEWS AND INTERVIEWS.

Three recent legal cases lead a daily paper to the conclusion that here is a vast field for conjecture and speculation, and mathematicians could have no more engaging task than to solve some problem of this sort: "If two kisses are worth $10,000 in Pennsylvania, how much should a Harlem doctor pay to an aggrieved husband for alienating his wife's affections, and what would be the proper remuneration for a widow whose husband has been taken away from her by a defective wire operated and owned by an electric light and power company?" Momentous issues rest upon the solution of just such problems as these, and it would be well to have some one determine relative anatomical values in a definitive way.

A recent decision of the New York Court of Appeals is to the effect that a street-car conductor can not be required to make change for more than two dollars in receiving a passenger's fare, and that to extend the amount to five dollars would be unreasonable and burdensome.

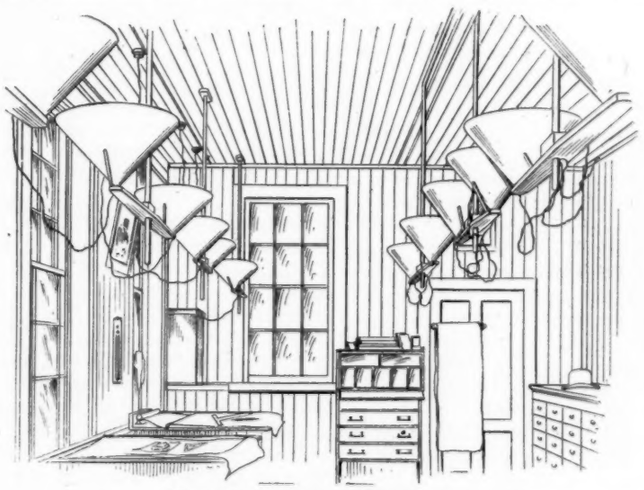
There is an average difference of one-quarter cent in the selling price of Lake Superior copper and the copper from Montana, Arizona and elsewhere, which is reduced by electricity. The copper from Lake Superior mines is taken out in its native state and is absolutely pure, except for the considerable amount of silver and the trace of gold which are found with it, but the precious metals do not interfere with the commercial value of the copper, even if not separated from it. Native copper is found only in this district, and the copper of other parts of the United States, England, Chili, Japan and the straits settlements is reduced from the ores. In the Montana district about half the production is now reduced by electrolysis, there being large smelters at Great Falls and Anaconda, Mont., though about one-half of the total product of the Montana mines is shipped East, mainly to Baltimore, in the shape of matte, most of the matte being exported for smelting in Wales, where the greatest reduction works in the United Kingdom are located.

The Cleveland, Ohio, Railway Men's Republican League has been incorporated, with a capital stock of $10,000. The object of the incorporation is for the advancement of political economy, the promulgation of the principles of the Republican party, the promotion of friendly and social relations among the members, and the better and more convenient discharge of the duties connected therewith. The incorporators are Thomas Marten, O. J. Ringle, Henry A. Bryan, Edward T. Hilton, Harley Hancock and Arthur E. Day.

Mr. Dudley introduced in the New York State Assembly last week a bill providing for the establishment of a board of gas, electric light and water commissioners, to consist of three members, to be appointed by the Governor of the State.

Lord Kelvin has received from the Paris Académie des Sciences one of its Arago medals in honor of his jubilee, and M. d'Abbadie, the Abyssinian explorer, the other. The Russian Academy of Science has elected Prof. Simon Newcomb, the astronomer, of Washington, D. C., who is attached to the United States Naval Observatory, an honorary member of that body. The academy has also conferred the same honor on two distinguished British scientists—Lord Kelvin, professor of natural philosophy at the University at Glasgow, and Lord Rayleigh, scientific adviser to the Corporation of Trinity House.

A New York exporting house will, in a few days, ship to Buenos Ayres a quantity of electric railway supplies. Some of the horse-car lines of that city will shortly be supplanted by the trolley system. A 750-horse-power engine is included in the shipment.



Electric Lighting by Reflection.

The committee on streets of the Chicago City Council has recommended that the General Electric Railway Company's franchise, giving it the right of way for an underground trolley road on 15 miles of streets, be granted.

President-elect McKinley pressed an electric button at his Canton home, 300 miles away, at 7 o'clock on January 6 and operated an electrical contrivance on the throttle of a locomotive at Silver Springs, N. Y., starting a vast consignment of 174 cars of salt over the Erie road for the New England States.

Electric Lighting by Reflection.

A few years ago several English cotton mills adopted a system of electric lighting by reflection, in which inverted arc lamps were used. Nothing much seems to have been done in a similar way in this country. A method of lighting by reflection, in use at the drawing office of the Lane and Bodley Company, engine builders, Cincinnati, Ohio, is shown in the accompanying illustration.

The lighting is done by incandescent lamps, supported by a hanging rod from the ceiling and having a cross-arm below, to each end of which a lamp is attached, but inverted from the usual position. These lamps are surrounded by opaque reflectors, which allow no light to pass through them, but which reflect it upward to the ceiling. In the experimental arrangement which is still in use, these shades are made of heavy drawing paper, blueprinted on the outside to render it more opaque. The paper throws the light up to the ceiling, which, together with the side walls and all the furniture in the room, is painted white. The successive reflections from these surfaces result in filling the room with a soft diffused light which casts no shadows, and under which work is so agreeable that the men linger at night over their drawings. Mr. Lane states that the light is better than daylight, softer, more agreeable and restful to the eye, and casting no shadows upon the drawing paper from any direction.

Two of the lights are mounted over each drawing board. The general arrangement of the shades will be apparent from the illustration, for which, and the above particulars, we are indebted to the *American Machinist*. If such an arrangement works so well in Cincinnati, where the coal soot must have a very bad effect on the white paint, it should certainly work even better in cleaner cities and towns.

Mr. Gerald Hart, of the Hart & Hegeman Manufacturing Company, Hartford, Ct., made a brief visit to New York city last week.

Edison on Ocean Telephony.

A reporter for the New York *Herald* recently said to Thomas A. Edison: "If you were backed by a ten-million-dollar syndicate, would you undertake to construct a practical working telephone across the Atlantic Ocean?"

"It is impossible," he replied, brusquely.

"There is a Russian who has telephoned under 10 miles of water," I continued, "and who claims that he can easily telephone across the Atlantic Ocean. He is being backed by a syndicate, and it is said that work will shortly be commenced on a submarine telephone cable."

Without a word Mr. Edison picked up a pad of paper and began to figure and talk.

"Let me see," he began. "The difficulty of telephoning increases according to the square root of the distance. He telephoned 10 miles under water, did he? Well, he must have had some little trouble. At 10 miles his difficulties are, we will say, one. At 20 miles his difficulties would be four. Then they would run up as follows:

At 40 miles	16 times as hard
At 80 miles	64 times as hard
At 150 miles	256 times as hard
At 320 miles	1,024 times as hard
At 640 miles	4,096 times as hard
At 1,280 miles	16,384 times as hard
At 2,560 miles	65,536 times as hard

"This is about the distance across the Atlantic Ocean. Now, if that Russian can tackle and overcome a job 65,000 times as hard as telephoning under 10 miles of water, he may possibly telephone across the Atlantic Ocean. It is not a question of battery, but of leakage and the overcoming of resistance and the impossibility of getting rid of the current at the moment the voice ceases. Imagine, if you can, a two-inch pipe running across the Atlantic Ocean. We will imagine, also, that the human voice consists of water. The man talking at this end would have to howl a long time before he could fill that tube and pour his voice out at the other end, wouldn't he? Well, when he got it filled and finally stopped talking, the man at the other end would have to wait an equally long time for the water to run out before he could get it going his way.

"Such a distance, especially such a submarine distance, affords entirely too clumsy a channel for the quick and variable current necessary to a telephone wire. As I said before, it is not a question of battery. Why, with the battery now on the Atlantic cable I can run a fan motor at either end. At the same time the speed of the motor could not be varied quickly enough to make its starting and stopping a matter of a few seconds.

"Taking these things into consideration, I am afraid the eminent Russian has a heavy job ahead of him.

"We are working on a few things here that may interest the public in the future," said Mr. Edison, as he moved off to his laboratory. "Of course, I can not divulge the nature of our work at present.

"By the way, I will say this much about long-distance telephoning: If I could erect poles three miles high I would undertake to telephone around the earth. As you approach the earth, however, the difficulties increase greatly, as they are of such a nature that I am afraid they can never be overcome—at least, not with present human intelligence."

More West End Bonds.

The Massachusetts Railroad Commissioners have approved the issue by the West End Street Railway Company, of Boston, of $2,000,000 four per cent 20-year bonds to be used for the following specified purposes:

One million dollars bonds to be applied solely to paying and funding existing floating indebtedness incurred in building extensions, purchases of real estate, etc.

Six hundred thousand dollars bonds to be applied solely to defray necessary cost of building extensions, and of new construction, equipment, lands, buildings and other permanent additions, which were in progress or had been contracted for on December 1, 1896.

Three hundred thousand dollars bonds to be applied solely to defraying cost of extensions or other permanent additions during 1897.

One hundred thousand dollars bonds to defray cost of equipping the new subway.

Electric Power for Ohio Mines.

A scheme has been put on foot at Columbus, Ohio, under which it is proposed to construct mammoth electrical plants in the valleys, with a central power-house as an accessory, from which will be furnished electric power to operate machinery to be placed in the contiguous mines. If the scheme does not miscarry, central power-houses will soon be erected in Jackson County, at Wellston and Coalton, as experiments. Among the advantages considered by the operators is that the lighting of mines by electricity will make fires practically impossible. About 30 mines will benefit from the experiment in Jackson County.

Impresario Greene.

Mr. B. E. Greene, who made quite a stir in electrical newspaper work, is now devoting his time to trade expositions in connection with the Grand Central Palace. Mr. Greene is the promoter of the New York show of the National Cycle Board of Trade, which occupies three and one-half floors of the Grand Central Palace, beginning February 6. He is also the general manager of the Music Trades Exposition, to be held in June. The latter is the first exposition of the kind to be held in this country.

Mr. James F. Cummings, of Detroit, manufacturer of the well known armorite interior conduit, arrived in New York city last week, and is stopping at the Imperial.

NIAGARA POWER IN BUFFALO.

BANQUET GIVEN IN HONOR OF ITS SUCCESSFUL TRANSMISSION.

The Cataract Power and Conduit Company, of Buffalo, celebrated, Tuesday evening, January 12, the successful transmission of Niagara Falls power by means of electricity to that city. The celebration took the form of a banquet at the Ellicott Club, at which there were 400 guests. There were present on this occasion a thoroughly representative body of electrical gentlemen, many of whom possess names of national and international reputation. It was indeed a remarkable event that could bring around one board such able minds and zealous students of electricity as Nikola Tesla, Charles F. Brush, Elihu Thomson, Frank J. Sprague and numerous others from the scientific and practical branches of the electrical world. Mr. Francis Lynde Stetson was the toast-master, and his carefully prepared statement of the work of the Cataract company was listened to with the closest attention by all. Mr. Tesla spoke on "Electricity," and his thoughtful words were closely followed, and it was regretted by every one that the departure of his train compelled him to leave before the completion of his address. Other speakers of electrical note were Mr. Brush, who complimented Buffalo on the advantage that the power of Niagara Falls is sure to bring to her, and he was followed by Prof. Elihu Thomson, who took occasion to accord in very courteous words a special indorsement of Mr. Brush as the original inventor of the arc lamp and dynamo. Mr. Charles R. Huntley, who, with Mr. George Urban, is to be complimented on the arrangements of this particularly successful and interesting occasion, was compelled by the audience to address them before they adjourned. Mr. Huntley took occasion to name many of the individuals of electrical renown present, and to express his personal appreciation of the trouble they had taken in coming long distances to assist in this important celebration. Mr. Huntley also called attention to the fact that a few years ago he had expressed the belief, when president of the National Electric Light Association, that it would be impracticable to utilize the power at Niagara Falls in the city of Buffalo, and he was now pleased to admit in this public way his mistake and to express his faith and zeal in the extension of electric power for all users in his home city of Buffalo.

A great many of the visitors arrived in Buffalo early on the 12th and visited the model power-house of the Buffalo Street Railway Company, through which they were kindly shown by General Manager H. H. Littell. The facilities of the Niagara Falls & Buffalo Electric Railway were placed at the disposal of the visitors, and a large party, under the guidance of S. Dana Greene and W. L. R. Emmett, visited the Falls and were shown through the power-house at Niagara Falls and the many other interesting installations at that point. The Carborundum works, of which Prof. E. G. Acheson is president, were visited, and the process of manufacturing this original product was observed with much interest.

The names of the electrical gentlemen present at the banquet are published below, and probably comprise as large a gathering of men of deeds in the electrical field as ever assembled on one occasion. The directors of the company giving the banquet are the following named gentlemen, all of whom, except Mr. Astor and Mr. Rankine, were present: D. O. Mills, Francis Lynde Stetson, Edward D. Adams, John Jacob Astor, Edward A. Wickes, Daniel O'Day, Geo. Urban, Jr., Charles R. Huntley and W. B. Rankine. At the head table, in addition to the directors, were Chas. F. Brush, Elihu Thomson, Frank J. Sprague, Chas. A. Coffin, L. Bannister, S. Dana Greene, C. A. Terry, H. H. Littell, Coleman Sellers, L. B. Stillwell, J. A. Roberts, John Bogart. The electrical table occupied the place of honor in the center of the beautiful dining-room. Among those seated were J. P. Ord, Frederic Nichols, E. W. Rice, W. A. Brackenridge, Webb Hayes, W. L. R. Emmett, T. C. Martin, J. S. Humbird, J. G. White, B. F. Miles, E. A. Sperry, W. H. Lawrence, David B. Parker, H. M. Watson, E. J. Hall, J. Metcalf, F. McGraw, T. H. Feary, Burt Van Horn, S. M. Hamill, F. A. Gilbert, E. G. Acheson, J. A. Butler, Chas. W. Price, H. A. Foster, C. P. Steinmetz, P. M. Lincoln, H. G. Stott, W. J. Johnston, I. Potter, H. P. Bissell, W. Caryl Ely, J. Marston, J. Morgan.

Another Underrunning Trolley Injunction.

In the United States Circuit Court, at Pittsburgh, Judge Acheson, on January 14, granted a preliminary injunction restraining the Steel Motor Company, of Lorain, Ohio, from manufacturing and selling underrunning trolley equipment, the controlling patents of which are owned by the General Electric Company. This is said to be the last firm in the country which makes underrunning trolley equipment that is not under injunction.

Copper Production.

The United States copper production in tons of 2,240 pounds for 1896 was 203,894; in 1895 the output was 171,067 tons; in 1894 the output was 159,623 tons, and in 1893 the product was 142,490 tons.

As compared with this the European copper production for 1896 was 86,396 tons; in 1895 it was 86,278 tons; in 1894 the output was 88,531 tons, and in 1893 the product was 81,785 tons.

A Canadian Road Reorganized.

The Ottawa Electric Street Railway Company has been reorganized by Boston, Chicago and Ottawa capitalists, with a capital stock of $100,000.

NIAGARA POWER IN BUFFALO.

REMARKS OF PRESIDENT FRANCIS LYNDE STETSON AT THE BUFFALO BANQUET, JANUARY 12, 1897.

To these festivities, which you have honored by your presence, the Cataract Power and Conduit Company, of your city of Buffalo, has requested me to bid you welcome, and to make a brief statement concerning the part taken by the company in the introduction of Niagara power into this Queen City of the Lakes.

Shortly after enterprising citizens of Buffalo had proposed to give $100,000 as a prize for the device of a practicable method of using the Niagara power in Buffalo, there was organized in 1886, exclusively by citizens of Niagara Falls, the company which since 1889 has been known as the "Niagara Falls Power Company," or the "Tunnel Company," and which, in July, 1889, entered into a contract for the construction of its works at Niagara.

This contract was made with the Cataract Construction Company, composed then exclusively, and now principally, of citizens of New York. In the course of the six years since this original contract the Cataract Construction Company, without thus far receiving one penny of profit or dividends, or interest, has provided for expenditures exceeding $6,000,000 in money, exclusive of interest, thereby acquiring substantially all of the stock of the Niagara Falls Power Company.

Incidentally, the Power company has promoted the formation and the business of the Niagara Falls Waterworks Company, and of the Niagara Falls Junction Railway Company, and also of the Niagara Development Company, intended for the provision and establishment of a satisfactory residential district for employés connected with the various industries established and to be established around the power-house at Niagara Falls.

Naturally, the interest and object of first importance to the Niagara Falls Power Company would be the establishment and development of its installation at Niagara; but, notwithstanding the fact that the employment of its power at Niagara Falls would be much more profitable than its transmission for use elsewhere, it was and is impossible for the company not to recognize the ultimate benefits both to itself and to this community of providing for the use of its power in this great, growing and enterprising city of Buffalo.

Accordingly, in October, 1894, the Niagara Falls Power Company made application to the local authorities of Buffalo for the right to introduce Niagara power into the city, and to make use of the city's streets for its transmission and distribution. That this application was not granted in precipitate haste or without due consideration is indicated by the date of the franchise, which was approved by his honor, the Mayor, on December 16, 1895, 14 months after the original application.

As granted, the franchise was free from a number of conditions originally proposed, which to the Power Company seemed unduly onerous, in view of the fact that now, at its own risk and without asking compensation, it was offering to bring about the result for which, a few years previously, public sentiment in this city had proposed to give a prize of $100,000. In its final form, the franchise was intended to be fair to both parties, and no reasonable complaint of its conditions can be made by either, although some modifications may yet become necessary, as to one of which presently I shall have something more to say.

Naturally enough, the Niagara Falls Power Company, in the introduction and distribution of its power in this city, desired local support and assistance. Accordingly, several prominent and public spirited citizens of Buffalo were induced to organize the corporation now known as the "Cataract Power and Conduit Company," to which, with the consent of the Common Council, under the twelfth article of the franchise, the Niagara Falls Power Company has assigned its grant, and this new Cataract Power and Conduit Company, directed principally by citizens of Buffalo, has undertaken the duty of distributing, within the city limits, the power brought to the boundary by the Niagara Falls Power Company.

The franchise of December 2, 1895, required the Power company within 90 days after acceptance of its provisions to present, and to file with the Board of Public Works, for its approval, and for the approval of the Common Council, plans and specifications for its work, and with this condition the Power company strictly complied. It was further required that on or before June 1, 1897, the company should be prepared to supply 10,000 horse-power to consumers within the city, and with this condition the company has so far complied that upon the first day of December, 1896 (six months before the specified date), it introduced into the city of Buffalo 1,000 horse-power, which from that time on has been satisfactorily employed by the enterprising, intelligent and public spirited directors of the Buffalo Street Railway Company, whose president and whose manager we are glad to see here tonight, and to whose justifiable confidence in the sufficiency and continuity of Niagara power the city of Buffalo is indebted for this early introduction.

It is, however, proper to observe that a reasonable postponement of the date before which the remaining 9,000 horse-power shall be required to be ready for use in this city will be necessary. It is entirely credible that, like the business men of every other city of the United States, the citizens of Buffalo found the Spring and Summer of 1896 exceptionally unfavorable for the promotion or prosecution of business enterprises involving novel elements, or calling for the expenditure of considerable sums of money. But whether or not this were so in Buffalo, it is true that during the year 1896, and prior to November 4, few corporations undertook or accomplished in the way of new construction more than did the Niagara Falls Power Company and the Cataract Power and Conduit Company in the installation of the line for generating and transmitting the Niagara power now in use in the city of Buffalo. Naturally enough, all desired that such installation should be established with such care as to avoid, so far as possible, the chance of failure and disappointment in operation, and, therefore, it was deemed best not to provide all the new machinery required for 10,000 horse-power until after the actual test of the transmission of the 1,000 horse-power, for the delivery of which upon December 1 Mr. Littell contracted in August, 1896.

This actual test having been made with results wholly satisfactory, the Niagara Falls Power Company now has concluded its contracts for the immediate generation of not merely 10,000 but of 25,000 additional electrical horse-power, of which as much as required will immediately thereupon be available for transmission to Buffalo. The contracts for this purpose have been actually assented to, and the money therefor has been actually provided.

The contract for an extension of the wheel pit sufficient to receive all the machinery for 50,000 electrical horse-power was made in May, 1896, and work thereunder has been and now is proceeding with the stipulation for its completion during the month of May, 1897.

It had been supposed that the turbine wheels and the generators also could be furnished before that date, but the contractors are now unable to promise such completion, and, accordingly, there must be an extension of the period within which the delivery of the remainder of the first 10,000 horse-power to this city shall be required, so as to enable the contractors progressively to furnish the five turbines and the five dynamos for which, as I have already said, the contracts have already been made and the money provided. We have no doubt that the public spirit of Buffalo, which originally perceived the city's peculiar and great advantage in its proximity to Niagara power, will now recognize the appropriateness of the request for such an extension, and by prompt acquiescence will encourage and stimulate the extended provision of Niagara power for use in this city.

It is a pleasure to be permitted to welcome here one of the most distinguished sons of Buffalo, the Comptroller of the State of New York. For it is not to be forgotten that through the wise and liberal disposition of the executives and legislatures of the State, the development of the Niagara power has been made possible within its boundaries.

Rights in respect of the Niagara power, upon the Canadian side, have been granted by the Province of Ontario upon terms which, though specially advantageous to the Province, are in some particulars more favorable to the company than are those conceded by the State of New York. For while it is true that the Canadian Niagara Power Company is under agreement to pay to the Province of Ontario an annual rental of $25,000, this rental secures to that company the right to place its works inconspicuously within the limits of the public reservation, and so near to the very Falls themselves as to avoid more than 6,000 feet of tunnel, which upon the New York side had to be constructed at a cost of nearly $600,000, to bring the power-house of the company above the limits of the State Reservation. It requires but a moment's calculation to show that the interest upon the additional construction required in the State of New York is more than equal to the entire rental paid to the Province of Ontario, and that thus I am justified in saying that in some particulars the Canadian grant is more favorable to the company than that in the State of New York, although there results to the Provincial treasury a pecuniary profit which similarly might have resulted to the State of New York, except for the requirements as to the position of the company's works.

From beginning to end the power company has recognized the glory of Niagara Falls as the first object of great natural beauty and power upon the face of the earth; and, therefore, while conscious that its works on the American side might have been constructed as near to the Falls as will be those of the Canadian Niagara Company, without conspicuous or undesirable interference with the aspect or the volume of the mighty river or its cataract, the officers of the Power company have cheerfully acquiesced in a requirement which has resulted in the erection of its beautiful building and works at a point more than a mile above the Falls and utterly beyond observation therefrom.

The result thus accomplished, with every promise of immediate and satisfactory extension, for this, the second city of the Empire State, may also in a future not far distant be made available under conditions, of course, less favorable than those here prevailing, but still upon terms advantageous to other cities in our State, and also for use as required upon the canals of the State. For, though the Niagara Falls Power Company has no relation whatever to any grant upon the canals, excepting a license for its very slight use of canal lands in Niagara and Erie counties, it can not fail to recognize the energy and enterprise of other organizations which may become users of Niagara power for the relief of the important interests, which, either in the ownership or the navigation of canal-boats or of their cargoes, contribute largely to the commercial importance of the Empire State and of its cities upon the line of the canal and of the Hudson River.

Under these conditions, the promoters of the use of the Niagara Falls power and its electrical transmission feel that, not improperly, they may presume themselves in some degree to be working for the public benefit as well as for legitimate personal profit.

Such, too, is the position which the Cataract Power and Conduit Company desires to occupy with reference to the City of Buffalo. This company hopes and believes that an extensive and continuing use of Niagara power in this city not only will result to the material and financial advantage of those now producing nearly 40,000 horse-power from steam engines at a cost believed to be at least twice that of Niagara power, but also will relieve this beautiful guardian of Lake Erie and the Niagara River from the veil of smoke so often obscuring her charming aspect. While it is true that in this particular Buffalo already is more fortunate than some of her western neighbors, still it is to be desired that, availing of the opportunity which she alone possesses, she may entirely cast off this pall.

Extended investigation by this company into the cost of steam power from coal, or from oil, or from natural gas, in the various cities of the world has convinced us all that nowhere upon this earth has any great city such an advantage as that now opening for Buffalo through this introduction of Niagara power; and in sanguine expectation of such prosperity and profit, which can result only from a service that shall be equally profitable and satisfactory to this city, the Cataract Power and Conduit Company bids welcome to the citizens of Buffalo, and to its Mayor, from whom we all now desire to hear.

American Institute of Electrical Engineers.

The 111th meeting of the Institute will be held at 12 West Thirty-first street, New York city, on Wednesday, January 20, 1897, at eight o'clock P. M. The evening will be devoted to the discussion of the following topic: "Electrically Driven Vehicles."

The discussion will be opened by Mr. A. L. Riker. Gentlemen seeing this notice, who are not members of the Institute, are cordially invited to attend.

TELEPHONE NEWS AND COMMENT.

The next quarterly statement of the Erie Telegraph and Telephone Company will be ready about January 29, when the directors meet for the declaration of the regular $1 per share dividend.

The longest commercial distance at which the long-distance telephone is now operated is from Boston to St. Louis, a distance of 1,400 miles. The line is almost twice as long as any European telephone line.

The New England Telegraph and Telephone Company is to establish a Back Bay telephone exchange in Boston on Newbury street, corner Exeter, to relieve the Tremont exchange. The name of the new exchange will be "Back Bay."

The Erie Telegraph and Telephone Company increased its wire mileage in 1896 nearly 40 per cent, and has now over 42,000 miles in operation, fully 35,000 miles being copper. The company has under ground 12,000 miles, and has nearly 12,000 miles of long-distance copper circuit.

At the annual meeting of the stockholders of the Citizens' Telephone Company, St. Joseph, Mo., the board of directors was re-elected and the officers were again elected, as follows: M. M. Riggs, president; J. J. Newell, vice-president; George A. Moss, secretary, and R. S. Frazer, treasurer.

The Home Telephone Company, of Cleveland, Ohio, which begins giving service to its patrons on February 1, has leased the brick block at 189 Prospect street for a period of 10 years. Its offices and central exchange are located there. It has 4,000 contracts, and connections are made for 650 telephones, it is claimed.

At Fort Wayne, Ind., on January 19, a meeting of companies and individuals interested in the independent telephone movement in Indiana held a meeting, at which several important questions were discussed. Judge R. S. Taylor, principal counsel for the government in the Berliner case, delivered an address. The matter of establishing long-distance connections throughout the State was also debated.

At the annual meeting of the Saco River, Me., Telegraph and Telephone Company, the following officers were elected for the ensuing year: President, Hon. M. P. Emery, Portland; vice-president, Hon. F. W. Hargraves, West Buxton; secretary, treasurer and superintendent, C. F. Clark, Hollis; auditor, J. W. Clark, Dayton. Directors, M. P. Emery, John Berryman, S. B. Shepard, H. F. Hargraves and C. F. Clark.

Observations have been made by Colonel Bellou, of the French artillery, that if a telephone is in sufficient proximity to, although not in actual contact with, a telegraph line, certain sounds are produced in the telephone whenever a message passes along the telegraph line. He has now succeeded by long-continued experiments in drawing up a system showing the phonetic impression produced by each letter of the Morse alphabet, and thus enabling any one, with some practice, to read, by the sounds of the telephone, any message circulating in a neighboring line. It will be readily understood that this discovery may be of great importance in war time, as in this way a telegraph line might be "tapped" without in any way interfering with the current circulating in it, and hence without the slightest indication to the stations connected by the line.

According to the experiments of Dr. Bertram Thornton, the telephone promises to be of material use in the education of those deaf mutes who possess a fragment of hearing power, and it has this advantage over the single speaking-tube that is sometimes used: In the first place, with it a teacher can instruct a group of children at the same time; secondly, it is not necessary for the teacher to apply his mouth close to the transmitter; the pupils have a full view of his features, expression and lip movements, which is not the case when he has to direct his attention and his voice into the mouth of the speaking-tube or trumpet. It is well known that in most cases of deafness the actual hearing part of the apparatus, so to speak, is capable of performing its function, but the mechanism for collecting the sound waves and transmitting them to the cochlea and its appendages is defective. This is also the case in a large proportion of instances of deaf-mutism. In using the ordinary speaking-tube the voice of the speaker is increased in intensity to an almost painful degree, and the lips have to be placed close to the mouthpiece. By using the telephone an intensification of the voice, at least equal to the most improved form of ear-trumpet, is obtained at a distance varying from six inches to one foot from the mouth of the transmitter. Dr. Thornton has found this fact an immense help in the teaching of deaf mutes. He mentions two cases in which the utility of the telephone was materially manifested. The first was that of a young woman with nerve deafness, so extreme that it was necessary to speak at the top of one's voice within two or three inches of her ear to enable her to hear. With the telephone he was enabled to converse with her in a subdued voice, with his mouth 26 inches away from the transmitter. In this case she received some assistance from reading his lips, though she was only a beginner in the accomplishment. In another case, a man with a similar degree of deafness was able to hear his wife and another person conversing with him in tones raised hardly above a whisper, they being inside the room and he outside, with the door shut. The value of the telephone in deafness, it is claimed, is not yet half appreciated, and many progressive aurists are now devoting a good deal of time to the study of the subject.

Electric Railways.

Mr. C. D. Wyman has received the appointment of general manager of the New Orleans Traction Company.

A rule has been made recently, and will be enforced by the Troy City, N. Y., Railway Company, that no passengers shall be allowed to ride on rear platforms of the cars if there is room inside.

The appellate division of the New York Supreme Court has rendered a decision upholding the validity of the trolley speed ordinance adopted a couple of years ago by the Brooklyn Board of Aldermen.

The Superior Court at New Haven, Ct., in a suit for damages, recently, gave a decision holding that except in exceptional conditions of danger a conductor is not bound to assist a passenger in alighting from a street car.

It has been reported that the officials of the New York & New England Railroad Company contemplate an extension of the double track of their road from Forestville to Bristol, with the view of electrifying this portion of the road.

At the annual meeting of the Fair Haven & Westville, Ct., Street Railway Company last week at New Haven, it was voted to issue $300,000 new stock to stockholders at par. Six hundred thousand dollars is already outstanding and commands $240 a share.

Three changes were made in the directory of the Cleveland, Ohio, City Street Railway Company last week, John J. Shipperd, Frank De Hass Robison and Charles Hathaway, Sr., being succeeded by J. B. Hanna, George Mulhern and S. T. Everett. Another dividend was passed.

Mr. Mark Walsh filed a petition in the District Court of Des Moines County, asking that the mortgage on the Burlington, Iowa, Electric Street Railway Company, to the amount of $280,000, be foreclosed, and that the property be sold for the benefit of the bondholders. The suit is brought in the name of the American Loan and Trust Company, of New York.

The Marlboro, Mass., Street Railway Company has elected the following officers for the ensuing year: S. H. Howe, president; T. T. Robinson, Boston, treasurer; F. L. Claflin, clerk. Directors, S. H. Howe, O. P. Walker, T. T. Robinson, L. P. Howe, E. I. Sawyer, H. E. Bradford, F. L. Claflin. H. E. Bradford was elected superintendent for the coming year.

A report of the Massachusetts Board of Railroad Commissioners shows that there are 61 street railway companies in that State, representing a value of $59,220,717, besides numerous leased lines, several systems which are not now in operation and a number which are only partly completed. The net earnings of these roads for the year were $4,163,556, and of this sum the West End Railway, of Boston, earned $2,007,339. Nine new roads have been started in the course of the year.

Articles of incorporation have been filed for what will be a very comprehensive electric railroad system in Ohio. The projection contemplates the making of an electric road of the entire Cincinnati, Hamilton & Dayton Railway system, between Cincinnati and Toledo, and also between Dayton and Ironton. The new company is to be known as the Cincinnati, Hamilton & Dayton Traction Company, and under the articles of incorporation it is authorized to lease, own, acquire, build, operate or maintain, either alone or in conjunction with any other street, suburban, interurban or other railway company of street, suburban or interurban railways, to be operated by electricity, steam or any other motive power, to do a freight and passenger business. The capital stock of the company is $50,000. The following officers have been elected: D. G. Edwards, president; C. G. Waldo, general manager; G. R. Balch, secretary, and F. H. Short, treasurer.

ELECTRIC LIGHT FLASHES.

The annual meeting of the stockholders of the Edison Electric Illuminating Company of New York will be held on February 9. Books closed January 14 and will re-open February 10.

At the annual meeting of the Bristol, N. H., Electric Light Company the following officers were elected: David M. Culley, clerk; George A. Emerson, George C. Currier, Simeon H. Cross, Clarence N. Merrill, Charles H. Proctor, Charles H. Dickinson and Charles Boardman, directors.

Following are the new directors of the Columbia, Pa., Electric Light and Power Company: Dr. Alex. Craig, E. B. Eckman, J. H. Herr, J. A. Minich, S. A. Bockius, A. J. Kauffman, Dr. T. M. Livingston, A. Z. Staman, Newton Jackson, H. H. Cramer, S. W. Guiles, C. R. Strickler and Dr. A. W. Rogers.

The Edison Electric Illuminating Company of Brooklyn, N. Y., has filed with the Secretary of State a certificate of increase of its capital stock from $3,750,000 to $4,000,000. The company has a paid-in capital of $3,750,000 and debts and liabilities of $1,250,000. The certificate is signed by Ethan Allen Doty, chairman, and R. C. Peabody, secretary of stockholders' meeting.

Big Lighting Combination in San Francisco.

The Edison Light and Power Company of San Francisco has been consolidated with the San Francisco Gas Light Company. A new company has been formed and called the San Francisco Gas and Electric Company, with a capital of $20,000,000, of which $13,846,000 has been issued.

AN APPARATUS FOR ILLUSTRATING PHASE-DIFFERENCES.

READ BEFORE THE SOCIETY OF ARTS, BOSTON, BY LOUIS DERR, M. A.

When a harmonic electro-motive force is applied to a circuit of ohmic resistance R, inductance L and

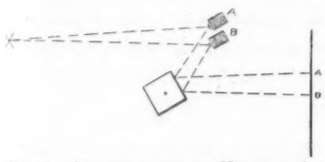


FIG. 1.—ARRANGEMENT OF MIRRORS, APPARATUS FOR ILLUSTRATING PHASE-DIFFERENCE.

capacity C, there exists in general a phase-difference θ between the electro-motive force and the resulting current, whose magnitude is expressed by the equation

$$\tan\theta = \frac{Lp}{R} - \frac{1}{CRp},$$

in which p is a quantity equal to 2π times the number of alternations of the current per second. From this equation it appears that θ may be positive, negative or zero, according to the relative magnitude of the two terms. If the circuit consists of an impedance coil, the second term is negligible, θ is positive and the current is behind the electro-motive force in phase; if the circuit contains a condenser only, the second term predominates, θ is negative and the current is ahead of the electro-motive force.

To show these and other phase-relations on a scale suited to lecture-room illustration, the apparatus here described has been devised by the writer, its operation depending on the principle that when an electric current is sent through a wire lying perpendicularly across a magnetic field a force is developed which urges the wire at right angles to both the direction of the field and the current. A powerful electro-magnet is mounted on an upright stone base and a wire is stretched across the field between its poles. At the top of the apparatus the wire terminates in the free end of a light metallic hinge, to which a small mirror is cemented. The to-and-fro vibrations of the wire may be observed by a beam of light reflected from the mirror to a screen, the hinge preventing all lateral motion and twisting. The other end of the wire carries a tuning-pin and a device providing a slight angular motion of the whole wire for adjusting the mirror.

An alternating current sent through the wire urges it alternately backward and forward, and if the tuning-pin is tuned until the period of free vibration of the wire coincides with that of the current, the wire springs into vigorous and distinctly audible vibration, and the spot of light reflected from the mirror on the screen elongates into a vertical line.

That this line is traced by the moving spot is easily shown by putting in the path of the reflected beam a mirror revolving about a vertical axis and thence reflecting to the screen. On turning the second mirror the successive positions of the spot fall in verticals, and the result on the screen is a very perfect sine curve, a faithful representation of the vibrations of the wire. Fig. 1 shows the arrangement of mirrors, using two wires.

With two such wires the observation of the phase-difference between two currents is easily made. With everything at rest, the mirrors are adjusted until the spots of light reflected on the screen are coincident. If now the wires are connected into separate circuits carrying currents, the lines of light on the screen remain superposed, the one corresponding to the stronger current appearing slightly longer than the other. On turning the revolving mirror any phase-difference between the currents is at once shown by the horizontal displacement of the lagging curve past the other, exactly as text-book diagrams of such curves are drawn.

To observe phase-differences between voltage and current under various conditions, one wire is connected to the terminals of the given circuit through a suitable non-inductive resistance. The resulting current will then be sensibly in phase with the applied electro-motive force, and the curve on the screen may be taken as representing the changes of the electro-motive force itself. The other wire, shunted if necessary, carries the current to be studied. One of the curves on the screen may be colored and thus identified by putting a slip of colored glass in front of the corresponding mirror. The phase-relations between voltage and current in circuits of different character may be conveniently compared by using a three-point switch and connections, as shown in Fig. 2, where L represents an impedance coil, R a non-inductive resistance and C a condenser. The circuits can thus be interchanged as rapidly as desired; and the instant shifting of the curves on the screen, corresponding to the character of the circuit employed and agreeing with the conclusions of a preceding paragraph, is quite striking. With the apparatus here shown a current of one ampere in the wire and a total length of about 30 feet in the reflected beam gives curves on the screen of two feet amplitude.

The angular relations between the currents in a polyphase circuit may be shown to an audience if the necessary number of mirrors is employed; the reactions of condenser and impedance coil upon each other in a circuit adjusted for resonance may be illustrated if a high-voltage condenser of large capacity is available; and the phase-relations between the primary and secondary voltage and current of a transformer may be demonstrated. Fig. 3 shows two-wire and three-wire apparatus, together with the 17-microfarad condenser and color-screens used in the experiments. A foot rule is also photographed, to show the size of the instruments. Exact dimensions are not given, as the size of every part may be varied within wide limits.

It should be stated that the results given by the apparatus in its present form are not quantitatively accurate within several per cent, especially if the currents in the wires are not truly sinusoidal. The discrepancies between calculated phase-differences and those observed with the apparatus, while unfitting it for precise measurement, do not, however, interfere with its usefulness as an instrument for purposes of illustration.

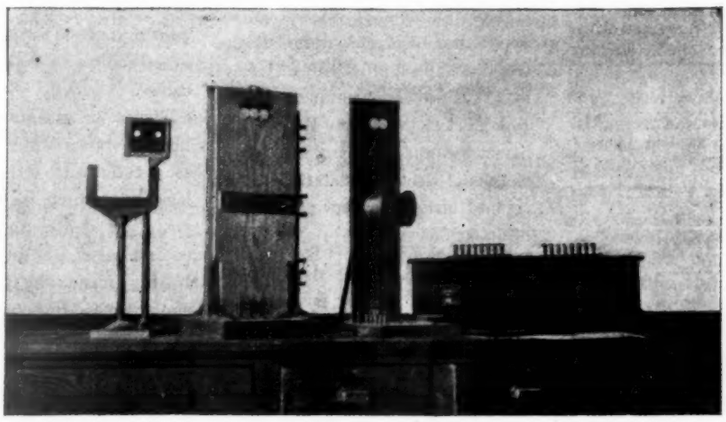


FIG. 3.—APPARATUS FOR ILLUSTRATING PHASE-DIFFERENCE.

Two hundred Topeka, Kas., people have signed a paper pledging themselves to support a new telephone company. The old company recently raised the rates, and the people are in rebellion.

Professor Rowland's Printing Telegraph.

The multiplex printing telegraph, invented by Prof. Henry A. Rowland, of the Johns Hopkins University, is about ready for commercial use, says an exchange. Dr. Rowland is at present perfecting the invention, and expects in a short time to exhibit the instrument. By the instrument an operator can transmit a telegram written upon a typewriter and have it reproduced in typewritten form at the receiving end. In addition to the typewriting part of the invention, Dr. Rowland, with his new machine, can send over the same wire five or six different messages at the same time in one direction, which, in duplex, makes 10 or 12 messages that can be transmitted on the same wire at the same time. Thus, with five operators at each end of a line, sending each an average of 30 words a minute, 300 words can be transmitted each minute. Dr. Rowland inquired at the Patent Office in Washington and was informed that no such invention has ever been received there, typewriting telegraphy having been attempted before, but upon entirely different principles. He has used a synchronous device in his invention, and in the mechanical arrangement of the typewriter has used but eight signals, the letters being produced by combinations. The current of electricity transmitting the message can be relayed, and in this manner the invention can be operated for great distances. When completed, Dr. Rowland says, the new instrument will be as convenient and as easily operated as the ordinary telegraphic dispatching and receiving apparatus.

LITERARY.

"A Great Hotel," which appears in the February *Scribner's* as the second article on "The Conduct of Great Businesses," gives some astounding facts as to this modern

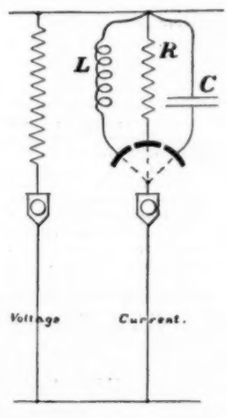


FIG. 2.—SWITCH AND CONNECTIONS, APPARATUS FOR ILLUSTRATING PHASE-DIFFERENCE.

development of one of the oldest businesses in the world. There are as many employés in a great hotel as there are guests; there is a man whose whole duty it is to wind clocks; one head waiter in a great hotel owns a yacht and a Summer residence; and hotels have their private blacksmith and paint shops.

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Special Notice to Advertisers.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

NEW YORK, JAN. 20, 1897.

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Our English cousins have gone as far into the electric railway problem as getting out a popular hand-book on "electric tramways and railways."

Governor Adams, of Colorado, walked to the Capitol at Denver to be inaugurated. His democracy would have been made even more prominent if he had ridden in a trolley car.

There is considerable activity among the independent telephone companies in the formation of State organizations for mutual advantage. The question of long-distance connection between the various towns in several States is being discussed at intervals.

The outlook for business in the electrical field is extremely encouraging. There are many large contracts to be placed, which include all kinds of apparatus. The wire and cable manufacturers, underground conduit makers, builders of electric railway apparatus and manufacturers of electric lighting supplies will, we believe, look back with satisfaction on 1897. In New York city alone the Metropolitan Street Railway Company will be purchasers of electrical material running up into many hundreds of thousands of dollars.

The banquet of the Cataract Power and Conduit Company, commemorating the introduction of Niagara power into the city of Buffalo, given at the Ellicott Club in that city Tuesday evening of last week, was a dignified and appropriate event. An account of the ceremonies and the address of Mr. Francis Lynde Stetson appear in this issue, and the interesting remarks of Mr. Nikola Tesla will appear in full in the ELECTRICAL REVIEW next week. It was a happy thought of the enterprising power company to thus celebrate this important triumph of electric transmission, with the most famous waterfall of the world as a source of generation. The men of great wealth, represented by Mr. Edward D. Adams, Mr. John Jacob Astor, Mr. D. O. Mills and Mr. Francis Lynde Stetson, should be given special credit for pouring out their means in support of this great electrical engineering work, and the able inventors and skillful artisans have, in the success of the undertaking, proved worthy of their trust. The ELECTRICAL REVIEW takes pleasure in congratulating them all, and also in giving words of high praise to Messrs. Charles R. Huntley, George Urban, Jr., and W. B. Rankine for what they have done, and which deserves a prominent part in the permanent records of this historical event.

ELECTRIC CAR HEATERS.

The utility, convenience and desirability of electric heaters in street cars operated by electricity is unquestioned. But why, in the name of all that is torrid, should the heaters be so placed as to scorch the calves of the passengers? A man who boards a trolley car on a cold or wet day is more likely to be suffering from cold feet than anything else. He finds the floor gratings cold and wet and must naturally rest his feet upon them, for if he assumes any other than an upright sitting posture he is liable to be considered eccentric, to say the least, or he may be put off the car. With his cold, wet feet on the cold, wet floor he begins his ride, but soon wonders why the calves of his legs smart so. Investigation shows that the electric heaters placed in the front panel of the seats are just high enough to avoid warming his feet and exactly high enough to frizzle his calves.

Warm air ascends—this fact can not be argued—and when the passenger alights from the car his trouser legs and clothing are filled with warm air. The chilly atmosphere rapidly cools him off, and if he isn't driven by this cause to the use of stimulants, the chances are he will find himself remarking next morning, "Oh, by dose; I'be god such a code in by head!" He may, furthermore, acquire pneumonia.

The question is this: Isn't there a better location for electric heaters than the one they now usually occupy? Why not place them in the floor of the car under the grating? A cover could be designed, it would seem, that would allow the heat to ascend into the car and at the same time prevent dirt and snow from falling directly upon the heater. Has such a scheme ever been tried? If not, why not? And if it has been tried, why didn't it work?

There may be the best of reasons for placing electric heaters as they are now placed, but something certainly can be done to get a better distribution of their heat and to cure them of their calf-scorching habit.

Mr. John Jacob Astor, one of the oldest and most valued subscribers to the ELECTRICAL REVIEW, has for some years been a patron of the electrical art. His appreciation of the practical advantages of electricity has recently been shown in the placing of contracts for the isolated plant in the new Waldorf Hotel, which will possess the largest electrical installation of its kind in the world.

1897 Calendars and Advertising Novelties.

Mr. P. F. McBreen, the "always ready" New York printer, is sending to his customers and friends his 25th annual calendar. It is a very neat piece of printing.

The Mitchell Tempered Copper Company, of Corry, Pa., are sending out a holiday remembrance in the form of a paper weight made of their pure copper in the form of an ox.

Bibber, White & Company, of Boston, announce on a very neat morocco desk calendar that they are manufacturers and jobbers of electrical merchandise and handle everything electrical.

The Phillips Insulated Wire Company, of Pawtucket, R. I., have issued a very serviceable and beautifully prepared calendar printed in colors, and giving valuable particulars in regard to their well known "O. K." wire.

George C. Easton, manufacturing stationer, New York city, is sending to his customers a well designed and well printed calendar printed in two colors and gold. The holidays in each month are very conveniently emphasized.

The Direct United States Cable Company, Limited, of London and New York, have prepared for their friends a very neat and serviceable pad and memorandum calendar bearing the well known device, "Mark your cablegrams 'via Direct Cable.'"

W. J. Moore, telephone manufacturer, of Caro, Mich., is sending out a very elaborately prepared calendar attached to a couch on which an Oriental beauty reclines. There is a good deal more of the Oriental beauty than there is of the calendar—but let that pass.

As handsome a piece of lithography as has ever been received in the ELECTRICAL REVIEW office is the new calendar issued by the St. Louis Electrical Supply Company, 911 Market street, St. Louis, Mo. There should be a great demand for this calendar, as it is really a work of art.

The Puritan Electric Company, 178 Devonshire street, Boston, are sending out a tasteful calendar advertising their noiseless inclosed arc lamps for alternating-current circuits and for constant-potential circuits. In harmony with the name of the company the body of the card carries a very pretty picture showing the Puritans on their way to church.

The Curtis Steel Roofing Company, of Niles, Ohio, are sending to their customers and friends an elaborately prepared calendar printed on large sheets, which also contain the weather signals predicting the kind of weather that may be expected on any day during the year. This calendar is not for free distribution, but can be obtained by sending 10 cents in stamps.

The Manhattan General Construction Company, of New York city, through its New England manager, Mr. H. C. Spaulding, of Boston, has sent to the ELECTRICAL REVIEW an artistic calendar advertising the Manhattan inclosed arc lamps. The design is very Frenchy in its character, and depicts in high-art style two female figures displaying, among other things, Manhattan lamps.

Superintendent Mason's Annual Report.

The annual report of superintendent of police telegraph F. C. Mason, submitted to superintendent of police Wm. J. McKelvey, of the Brooklyn, N. Y., Police Department, last week, shows that 210,030 messages were handled by the operators at headquarters during the year. The force consists of one superintendent, one chief operator, seven operators and four linemen, all members of the uniformed force, all having been promoted from members of the uniformed force of the next lower grade. There are in use at present 353 police patrol signal boxes and 440 telephones connected with the police telephone system. The department also has in use 569 miles of wire, 350 of which is strung on poles belonging to the department, and 219 of which is strung on the elevated roads, in conduits and under ground. Superintendent Mason strongly recommends that early steps be taken to put all police wires under ground. The work of the telegraph bureau, according to Commissioner Welles and Superintendent McKelvey, reflects great credit on Mr. Mason and his corps of operators. During the year 45,444 arrests have been made by the Police Department throughout the city. Two modern, up-to-date police stations have been constructed and fully equipped, everything being new and of modern design, especially as regards electrical appliances, patrol systems, etc. Twenty precincts now have the patrol-box system.

Wm. C. MacCurdy.

The firm of MacCurdy & Smith, of Indianapolis, Ind., having been dissolved on December 19 last, Mr. Wm. C. MacCurdy has opened an office in the Baldwin block, Indianapolis, as a manufacturers' agent and consulting engineer. Mr. MacCurdy has already secured agencies for a number of prominent firms and has several more pending. His prospects are flattering, and he intends to devote his energies to work in Indiana, Illinois, Michigan, Kentucky and Ohio.

Lansing City Electric Railway.

At the annual meeting of the Lansing City Electric Railway, held at Lansing, Mich., January 15, the old board of directors were unanimously re-elected. The directors elected the following officers for the ensuing year: L. N. Downs, president and general manager; J. J. Baird, vice-president; Laurence Barrett, secretary and treasurer.

Phœnix Interior Telephone Company.

Owing to a gratifying increase of business, the Phœnix Interior Telephone Company, of New York city, were last week obliged to remove to larger quarters. They are now installed in the five-story building at 93 Washington street.

THE FUTURE OF SELF-CONTAINED MOTOR CARS.

BY KILLINGWORTH HEDGES, IN LONDON "ELECTRICAL ENGINEER."

It has of late been the fashion to expatiate on the great development of the steam and gas propelled motor car, and to consider the electrical type to have been quite put aside by its more up-to-date competitors. The question of self-propelled vehicles has interested me from a very early date, my first practical experience taking place in 1868, when I was directed by Messrs. Easton and Amos, the firm of engineers with whom I was serving my time, to conduct a road-roller, which had been used in Hyde Park, to Rochester for repairs. My readers will think this a very simple task, but road rollers in those days differed as much from the modern Aveling & Porter type as the bone-shaker differs from the modern safety bicycle. It consisted of a portable engine supported on three enormous wheels, the width being too great to enable it to enter an ordinary gate, and its weight sufficient to seriously damage the bridge over the Serpentine on the one and only occasion when it was allowed to cross. However, with the help of crowbars and sundry planks, the various turnings through the borough were negotiated, and we arrived, with our boilers empty and steam blowing off, early one Sunday morning in front of a police station at Eltham, and were practically placed under arrest until my fellow pupil, the driver, told the sergeant that he could not answer for the safety of the station unless we were allowed to resume our journey, as the firebox was getting red-hot, and there was no means of running the feed-pump unless we kept on the move. I have a vivid recollection of the way we were assisted to fill our tanks by the constable on duty, the sergeant almost beseeching us to go on.

My first run on a motor car of modern design was in 1878, and those who remember the Blackburne dogcart will indorse my opinion that this invention quite forstalled the up-to-date steam-propelled vehicle of the present day. The Blackburne boiler consisted of a copper tube wound spirally, through which a small quantity of water was forced by a pump, to be flashed into steam; after being used in the engine the steam was condensed in a very compact air-condenser, also of tubes through which air was circulated by means of a fan. A petroleum lamp was used for heating purposes, and the engine ran constantly, but without the terrible vibration which is a leading characteristic of the modern gas-propelled car.

With regard to electric motor cars, one was surprised to find them singularly absent in the parade to Brighton, the reason given by those inventors who are working at the subject being that there was no time to arrange for the necessary relay of batteries. I can only say that I rode more than the distance between London and Brighton on the occasion of my visit to M. Bailly some eight years ago, and shall not forget my first experience of his electrically-propelled vehicle. I was met at the station, some 20 miles from Paris, by M. Bailly's coachman or motorman, who put my luggage into a very stylish dogcart, which had the usual appearance, but in place of the quadruped in the shafts, a small steering-wheel was fixed, to which were attached a pair of reins. These the man placed in my hands, after showing me how to start the motor by pressing my foot on a pedal, and stop it by removing the pressure. We made a good start, but did not negotiate the station exit very cleverly, and in the village found that working a steering-wheel by reins was a far harder task than driving a horse—in fact, our course was like the load curve of an electric tramway generating station—and I was relieved to find M. Bailly waiting outside the village. Several of these vehicles were made, and, as far as the accumulators were concerned, gave no trouble at all. The cells were of celluloid, shaped something like bottles; these were dropped into holes in a wicker basket similar to those used by wine merchants and slid under the seat. To my knowledge the batteries were not recharged during the next two days, when we took long drives into the country.

After a careful investigation of the systems which have been recently exhibited, I have great confidence in electrical motors for pleasure carriages, but for vans and vehicles to take heavy loads, steam appears to be most suitable; and when a history of the motor car industry is written, I hope that the honors will be given to Mr. Blackburne as the pioneer of the modern steam-driven carriage, and I think it would be a graceful act if those gentlemen who have taken up the subject commercially and boomed almost every foreign invention, would recognize our English *confrère*, who, although in his eighty-sixth year, is still hale and hearty.

KIND WORDS.

TRUE APPRECIATION.

TO THE EDITOR OF ELECTRICAL REVIEW:

Inclosed find the amount of my bill.

The Tesla articles alone place every subscriber to the ELECTRICAL REVIEW under special obligations to its managers. W. W. LITTLE, M. D.

January 14.

The next convention of the National Electric Light Association will be held about June 1, and Niagara Falls, N. Y., is to be the meeting place. The energetic president, Mr. Frederic Nicholls, of Toronto, has been untiring in his efforts to increase interest in this important event, and his work has already borne much fruit. There will be an unusually fine list of papers presented at the convention.

Mr. John T. McRoy, of Chicago, the manufacturer of the well known McRoy vitrified terra-cotta conduit, was in New York city last week and, it is understood, closed a good-sized contract with the Edison Electric Illuminating Company of Brooklyn, N. Y.

Discovery of a Non-Phosphorescent, Highly Fluorescent Crystal.

Until quite recently the scientific world, and particularly those who have devoted time and study to the nature and theories of Roentgen rays, has accepted as a conclusion that fluorescent crystals could not be otherwise than phosphorescent. After a long series of experiments, carried on in the Spring Park Laboratory, Jamaica Plain, Mass., by Mr. T. B. Kinraid, a combination of chemical elements was found which is much greater in fluorescent power than tungstate of calcium or any of the other salts, and is absolutely non-phosphorescent. So fully is the attribute of phosphorescence eliminated, that when the screen, composed of fluorescent crystals, is exposed to the rays of the tube the effect is instantaneous, showing the most vague shadows, which can not be traced when tungstate of calcium is used.

This discovery is likely to prove of great value in the practical application of X rays, and particularly in medical diagnosis its good qualities will be realized, because the perfect control of the rays are possible, and no afterglow on the screen remains.

A representative of the ELECTRICAL REVIEW was permitted by Mr. Kinraid to witness a demonstration of the results accomplished with this new non-phosphorescent crystal in the experimenting-room of the Spring Park Laboratory.

Electric Headlights.

Besides the main function of the electric locomotive headlight—to illuminate the road for the benefit of the engineer—it is a peculiarity of the beautiful arc light, backed by a powerful reflector, according to the *Railroad Gazette*, that it gives early notice to station men, wayfarers, runners of other trains, tramps and rabbits of the approach of the train bearing the light. In a number of instances this has been strikingly illustrated in the prevention of collision. The runner using this light can not see through a hill or a building any better than without it, but by shining above the hill or building the light will make its whereabouts manifested several miles in advance, so that other trains can know that the electrically-lighted train is approaching.

The illumination of particles of dust or moisture in the atmosphere makes a pencil of light, which, if the angle of the reflector is adjusted properly, may be seen in the air overhead many miles away, and this often makes an intelligible indication to runners of other trains, even if, by reason of a curve in the track between the observer and the point where the light is at that moment, the pencil is some distance from the line of the road.

The general manager of the Cincinnati, Hamilton & Dayton road is authority for the accuracy of the following report of an instance illustrating the value of this feature of the light: An engineer, running an unloaded engine at night, and with the tender foremost, forgot about a passenger train that was due, and would have met it on the bridge, over the Miami River at Hamilton, had he not seen the light from the electric headlight of the passenger engine before the latter could itself be noticed even during the daytime. The engineer succeeded in running back onto a sidetrack before the passenger train reached him.

PERSONAL.

Mr. J. George Kaelber, of the Western Electric Company, was among the visitors to New York city last week.

Mr. B. J. Arnold, of Chicago, was a recent visitor to New York city, making his headquarters at the new Manhattan Hotel.

Lieut. Frank H. Clark, general manager of the United States Electric Lighting Company, of Washington, D. C., visited New York city last week.

Mr. J. F. Outwater, purchasing agent for the Edison Electric Illuminating Company of Brooklyn, N. Y., is convalescing from a severe attack of the grip.

Mr. M. L. Livingston, assistant manager of the Standard Thermometer and Electric Company, Peabody, Mass., visited New York city last week and favored the ELECTRICAL REVIEW office with a call.

Mr. T. C. Rafferty, who is probably one of the best known men in the electrical supply business in the country, is now associated with the Metropolitan Electric Company, of Chicago, having disposed of all his other electrical interests. All of Mr. Rafferty's friends and customers will undoubtedly be pleased to learn of his new connection, which will afford him ample scope for his energetic work, enabling him to take care of his customers' wants in a befitting manner, and renew old and pleasant trade relations. The ELECTRICAL REVIEW wishes him every success in his new work and congratulates the Metropolitan Electric Company on their foresight in securing his services.

Trolley Car Knocked Through a House.

A press dispatch from Wilkesbarre, Pa., says that an empty passenger car attached to a freight train on the Wilkesbarre & Northern Railroad broke its coupling on January 9, near Dallas, and dashed down a heavy grade for several miles. When nearing Luzerne borough at a crossing, and at a frightful rate of speed, it came into collision with a trolley car. The force of the collision hurled the trolley car through the side of a dwelling house, and one passenger, David Smith, was fatally injured. Two brakemen were on the passenger coach, and they put on the brakes, but the chains refused to work and they jumped to save their lives. The passengers in the electric car saw the danger ahead and made a rush for the doors. All escaped injury, with the exception of Smith, who was dug out of the wreck.

A Big Niagara Falls Electrical Contract.

At a meeting of the directors of the Cataract Construction Company, at Niagara Falls, on January 12 a contract for five new generators of 5,000 horse-power each and corresponding exciters and switchboard apparatus was awarded to the Westinghouse Electric and Manufacturing Company, of Pittsburgh. This is the largest single contract for electrical power apparatus ever placed, and it is understood that it amounts to about half a million dollars. It constitutes the second great step in the installation of the Niagara plant, adding 25,000 horse-power to its present output. The new generators, together with the ones now in use, will make provision for furnishing to the city of Buffalo the additional power that is required for manufacturing, lighting and industrial purposes, and it is estimated that eventually from 25,000 to 40,000 horse-power will be consumed in Buffalo alone. The five generators are to be duplicates of the three already installed by the Westinghouse company. A further increase of 10,000 horse-power is contemplated in the near future.

American Air-Brakes in Germany.

The first 1897 order received by the Standard Air-Brake Company, of New York city, was one for 30 double-truck motor car air-brake equipments for Germany. The name of the line on which this apparatus is to be used is Oberschlesische Dampfstrassenbahn, but the brakes will only be used on the cars and not on the name. The Standard Air-Brake Company's motor-compressor type will be supplied, and there is another order for 30 more to come, making 60 car equipments in all. Mr. E. J. Wessels, general manager of the company, is feeling much encouraged over the outlook for foreign trade, requests for over 300 additional equipments having been received during the past week.

Packard Lamp Trade.

Notwithstanding the advance in the selling price of the standard makes of lamps, made necessary largely by the fact that the manufacturers have been operating under an actual loss for the past two years, the Electric Appliance Company, of Chicago, report that the sales on Packard lamps have increased since the time of the advance, showing that their customers appreciate a good thing and are willing to pay a fair price for a first-class article. The Packard lamp business has always been a very satisfactory part of the Electric Appliance Company's trade.

Length of the Roentgen Ray.

The wave length of Roentgen rays has been ascertained by Dr. Fromm, of Munich, at fourteen-millionths of a millimetre; that is about 75 times smaller than the smallest wave length for light. This determination was based upon interference phenomena observed by Dr. Fromm, says the *Scientific American*.

THE EQUIPMENT OF MANUFACTURING ESTABLISHMENTS WITH ELECTRIC MOTORS AND ELECTRIC POWER DISTRIBUTION.

READ BEFORE THE WESTERN SOCIETY OF ENGINEERS, DECEMBER 9, 1896, BY PROF. DUGALD C. JACKSON.

The theoretical treatment which this subject has heretofore received in papers before technical societies or articles in current periodicals has always appeared to me to be inadequate, and I have therefore undertaken to give a summary of the views held in a number of the great manufacturing establishments where experience has been had with electrical transmission and distribution of power. In a considerable proportion of these establishments electric power transmission has been used side by side with the mechanical transmission of power from the prime mover to the operating machinery. I propose to deal specially with the conditions which exist in establishments owning and operating their own complete and independent power plant.

The points to be considered in a comparison between mechanical and electrical distribution of power in manufacturing establishments, by which the advantages of one or the other are to be determined, are:

A. Comparative first cost.

B. Comparative operating advantages: 1, annual expense for fuel; 2, annual expense for attendance; 3, annual expense for repairs; 4, frequency and duration of breakdowns, and extent of the whole plant which is likely to be affected by a failure of any part; 5, convenience, as it affects the extent of floor space occupied by machinery; 6, convenience, as it affects the handling of product at the machines and to or from the machines, and the amount of product put through the machines; 7, safety; 8, cleanliness.

I will take these points up in their order.

A—COMPARATIVE FIRST COST OF ELECTRICAL AND OF MECHANICAL TRANSMISSION.

In the Case of a New Establishment—The first cost of electrical transmission within the confines of a manufacturing establishment which has its own independent and complete power plant is nearly always considerably greater than the first cost of mechanical transmission, such as by gears and shafting, belts and shafting, or ropes and shafting. In each case the steam plant is required. In the electrical equipment the required parts in addition to steam plant are electrical generators, electrical wiring, electric motors. These are considerably more costly under ordinary conditions than belts and shafts or other mechanical transmitters, even if we acknowledge an advantage in the efficiency of the electrical plant which permits a reduction of the total capacity of the steam plant when electrical transmission is used.

The electrical equipment being, under ordinary conditions, more costly, it must make sufficient annual savings to pay a profit on its extra first cost, or it has no reason for its existence.

In the Case of an Established Concern—The considerations of the last paragraph apply with extreme force

(Continued on page 34.)

The Claret-Vuilleumier Electric Traction System.

[*From Lightning, London.*]

The steady opposition of the Parisians to the erection of overhead conductors was for a long time a great obstacle to the adoption of electric traction on the tramways of the French capital. During the Summer of 1894, however, a tramway was run at Lyon from the Pont Lafayette to the Parc de la Tête d'Or, during the time of the exhibition, on which Mr. Vuilleumier—who, by the way, is an Englishman—experimented with a system of electric traction, the novelty of which was the successful use of underground conductors, rendering the erection of any overhead apparatus quite unnecessary. It is this system, slightly modified, which the municipality of Paris has lately adopted from the Place de la République to the suburb of Romainville. The line was opened to the public in June last, and is giving great satisfaction.

The most interesting and novel feature of Mr. Vuilleumier's invention is the method by which the current is brought into the car. A connector placed under the car receives the current from blocks of metal (six inches by six inches) placed about two and one-half yards apart along the line midway between the rails. The length of the connector is such that at the moment it leaves one metal square it comes into contact with another. These metal squares being on a level with the road, and quite unprotected, it was necessary that there should be current on them only at the time when they were covered by the car passing over them. Some means had, therefore, to be invented to electrify only one or two of the metal squares at a time, and likewise to pass on the current at the exact moment to each successive square along the line. Here lay a great difficulty, for a machine capable of supplying the current to each metal square in turn at the instant when the car approached it, and with the requisite rapidity and nicety, must necessarily be a very complicated and delicate apparatus.

But the inventor succeeded in carrying out his idea by means of very ingenious automatic machines placed at intervals along the line, and called distributors. The action of these distributors may be understood by the aid of Fig. 1.

The current leaves the dynamo M, Fig. 1, and enters the cable K, which is laid under one of the pavements parallel with the tramway line. This cable communicates every 100 yards with the distributors D, D^1, which send the current successively into the metal squares which constitute the points of contact between the lines.

The metal squares are connected together in pairs by a copper wire W, Fig. 2, run under the ground. The length of the tram is such that it always completely covers the pair, or pairs, of metal squares, of which the conductor CC of the car touches a single point. Each distributor controls 20 pairs of metal squares. The top of the distributor consists of a metallic crown of half a metre diameter, on which are arranged 20 oblong-shaped pieces of metal *a*, 1–19, Fig. 1. Thus there is one oblong for each pair of metal squares. Inside this crown are three other oblong contacts, 0, *b*, 20, placed outside the crown in the drawing, for the sake of simplicity. The oblong 0, the oblongs 1–19 and the oblong of 20 of each distributor are connected by separate wires to the pairs of metal squares numbered 0–20. But the pairs 19 and 20 of one distributor D are the pairs 0^1 and 1_1 of the

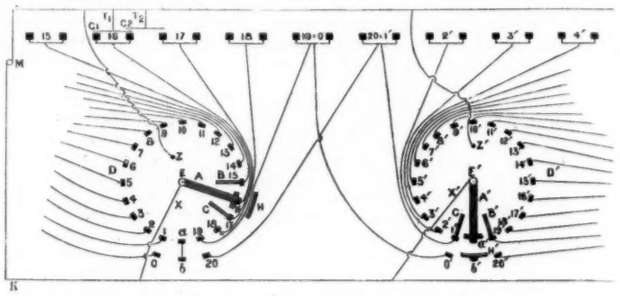


FIG. 1.—DISTRIBUTORS OF THE CLARET-VUILLEUMIER ELECTRIC TRACTION SYSTEM.

next distributor D_1. Further, there is a wire connecting the oblongs *a* and *b*.

Round the center E revolve four brushes, A, B, C, H, separately insulated, but simultaneous in their movement. The brush A is connected at E by a cable X to the main cable K, and can be put in contact successively with the oblongs *a*, 1–19. Its width allows it to be always in contact with at least one oblong, which it does not leave before reaching the next. The brushes B and C have contact with the same oblongs, but are not so broad as A. The brush H establishes contact between 0 and *b*, or between *b* and 20, but never between all three at the same time.

Each distributor is connected at Z

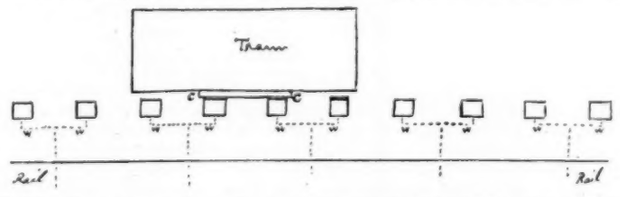


FIG. 2.—CONNECTIONS OF THE CLARET-VUILLEUMIER ELECTRIC TRACTION SYSTEM.

with the rail along which the current returns to the dynamo after passing through the motor of the car. By means of a very complicated arrangement, of which I speak later, the establishment of a current between the brush C and Z causes the whole of the brushes to move from one oblong to the next in the direction of the numbering. In the same way a current between the brush B and Z causes the brushes to move in the opposite direction.

As I have already said, the tramcar, which is represented in Fig. 1 by T_1 and T_2 in two successive positions, carries a connector C_1, C_2, sufficiently long to reach the approaching metal square before leaving the one behind. Suppose the car, advancing in the direction of the numbering, to be in the position T_1, C_1, in contact with the pair of metal squares 16, the brush A being also, of course, in contact with oblong 16. We have thus a circuit passing through M, K, E, A, the oblong 16, the metal square 16, C_1,T_1, R and M. Under the influence of the current passing in this circuit the car advances, but the distributor does not move until the connector of the car has reached the first of the following pair of metal squares; that is to say, arrived in the position C_2. As soon as the connector touches the first of the pair 17, and while the circuit just explained is still intact, there is formed a secondary circuit passing through the metal squares 16, the connector C_2, the metal square and oblong 17, the brush C, the point Z and the rail R. The effect of this secondary circuit is to cause the distributor to advance one oblong, and thus to bring the brush A on to oblong 17. No current can now pass through the metal square 16, and the situation becomes analogous to that already explained.

When the car is traveling in the opposite direction, the brush B determines the inverse movement of the distributor.

It remains to be explained how the current passes from one distributor to another. When the connector on the car, in a position similar to that of C_2, comes into contact with the pair of metal squares 19–0, there is a current passing through M, K, E, A, 18, C_2, the metal square 19–0 and the oblong 0^1, but here the current is stopped, the brushes A^1, B^1, C^1, H^1 being in repose; that is to say, A^1 in contact with a^1. The brush A passes from the oblong 18 to 19, and the car is still propelled by distributor D, the oblong 19 and the metal square $19–0^1$. But when A is on 19, the brush H forms connection between 20 and *b*, and, consequently, between 20, *b* and *a*, and the brush C at the same time is on *a*. When the connector reaches the pair $20–1^1$, there are established two circuits between this pair of metal squares and the rail, one by 20, H, *b*, *a*, C, Z, and the other by the oblong 1^1, C^1, Z^1. The two distributors advance one oblong, D thus putting itself into the position of repose as represented by D^1, and, consequently, sends no more current to the car, which is now propelled by the brush A^1, the oblong 1^1 and the metal square $20–1^1$.

It is necessary when a car, advancing along the line, comes into contact with each successive section, that the distributor controlling such section must be in a state of repose. And as we have just seen that a distributor can not be in a state of repose until the preceding car has left its section, it follows that two cars can not travel on the same section at the same time.

The arrangement of which I spoke just now, for establishing a current between the brushes C and B and the point Z, consists of a special magnet electrified by the distributor at each twentieth movement of the brushes round the crown. The details of this special mechanism can be found, by those who wish for further explanation, in the *Revue Générale des Sciences* of April 15, 1896.

The generating station is situated just outside Paris, on the road to Romainville. At present there are three 200-horse-power single-cylinder engines of the Garnier type. They drive three 140-kilowatt four-pole dynamos, which supply a current of 275 amperes at a pressure of 550 volts. There is room for three more sets of machinery.

The water is supplied by the city waterworks; but, in order to lessen the heavy expense entailed by a large consumption, a system of refrigeration has been devised, so that a great deal of the water is employed over and over again.

The station supplies the current for propelling the tramway, and also for lighting the streets through which the line runs. As a rule, only one dynamo is necessary for the lighting, while two are generally used for the traction. Each dynamo, however, has a special switch, enabling it to be turned over to the lighting or the traction circuit.

Each car carries a spare distributor ready to take the place of any one that may break down along the line. The distributors are placed in cast-iron boxes under the pavement, and so simple are the connections that this charge can be made in a few minutes.

The great number of wires employed, and the delicacy of the distributors which command them, may at times render momentary interruptions for repairs more serious than on other systems. I have already shown that two cars can not run at the same time over a single section. This is not likely to be a great inconvenience on a comparatively quiet road like the one to Romainville. But in very crowded thoroughfares, where blocks in the traffic are frequent, it would sometimes be found impossible to keep the cars the necessary distance apart. This difficulty can only be obviated by diminishing the length of the section controlled by each distributor.

The greatest merit of the system is that it keeps entirely out of sight all the apparatus necessary to work it, while its cost of construction and maintenance is slightly inferior to that of any other system. Whatever drawbacks it may possess do not appear to be of such a nature as to render impossible its universal adoption in Paris, for the authorities have already contracted for another line from the Boulevard Haussmann to another of the suburbs. This line is in course of construction.

ELECTRIC POWER IN MANUFACTURING ESTABLISHMENTS.

(*Continued from page 32.*)

in a case of a proposed change from mechanical to electrical transmission in an established concern, as such a change means, at the best, the abandonment of much operating transmission machinery. In some cases special considerations may enter, as is shown later.

The possible savings are discussed below under the respective headings belonging to the following divisions of

B—COMPARATIVE OPERATING ADVANTAGES.

1 and 2. *Annual Expense for Fuel and Attendance*—The following quotation from an editorial item which appeared in one of the technical journals nearly two years ago put the argument upon these points, which favors electrical power:

"It is perfectly clear that Messrs. ——— have derived to the fullest extent the great advantages offered by electric transmission; they have saved valuable spaces formerly occupied by steam engines, and they have abolished to a great extent the losses due to mechanical transmission. The concentration of the whole of the steam plant in one compact space has led to great saving in labor, the majority of the men who formerly attended to the scattered steam plant being drafted into other work. It should also be pointed out that large compound and condensing engines are used with consequent economy. The central station, which supplies the power, has a capacity of 1,500 horse-power. * * *"

"At the ——— mills there will doubtless be a gradual but complete abandonment of isolated steam plants, for the proprietors are completely alive to the manifold advantages of concentrating steam raisers. It is yet too early to expect detailed costs of working, but there appears to be the greatest satisfaction with the general performance of the electric machinery, and a settled conviction that it is the only system which can efficiently supply power to scattered buildings."

This argument seems to be well supported by experience in great manufacturing establishments where hundreds or even thousands of horse-power must be distributed over a considerable area. In the establishments of less magnitude, such, for instance, as use not exceeding 250 horse-power, it is questionable whether any very large fuel saving can be shown by the electrical plant under ordinary conditions, and certainly no appreciable labor saving can be shown in the power plant. These deductions are supported by the following quotations from records of the experience of a considerable number of manufacturing establishments, the names of which are in most cases synonymous with success:

Establishment A—Capacity of electrical power plant is 1,537 horse-power. Product heavy and bulky. "We have kept no record, but note no appreciable difference." (Referring to comparative fuel cost.)

Establishment B—Capacity of electrical power plant is 1,099 horse-power. Product heavy and bulky. "Can give no definite information, but confidently expect the electrical transmission system will show the best results." This plant has just been installed and has scarcely started running.

Establishment C—Capacity of electrical power plant is 633 horse-power. Product easily handled. "We think it is economical to use electricity as a motive power when it is desired to concentrate power centrally and distribute the same to different parts of the plant covering a large territory; that is, we think power can be distributed more economically by the use of electricity than by belting to long distances or by other means of transmission; and we also think it is a great deal more economical to concentrate our power than to attempt to distribute it in different parts of our plant by the installation of separate steam plants, or perhaps by distribution of engines, steam for which would have to be carried considerable distances. Can give you no comparative figures."

Establishment D—Capacity of electrical power plant, 600 or 700 horse-power. Heavy product. We "are not yet in a position to give you any information that would be of value at all, although our electrical experience would indicate that we had made a change in the right direction." This electric plant was lately started.

Establishment E—Capacity of electrical power plant, 400 horse-power. Product easily handled. "No figures, but considerable economy" in electrical plant.

Establishment F—Capacity of electrical power plant, 275 horse power. Product bulky. "We have made no comparative tests to determine whether or not we were saving any money by this system of distribution, it being largely with us a matter of convenience as at present operated."

Establishment G—Capacity of electrical power plant, not including cranes, 211 horse-power. Product heavy and bulky. "We find it much more economical to run by electricity than we did by steam."

Establishment H—Capacity of electrical power plant, 200 horse-power. Product easily handled, but cleanliness of importance. "In part of our works we transmitted power by means of belts and gears before we installed electric motors. We have recently added to our plant a new building, to be equipped with about 400 horse-power, in which we intend to drive all of our machinery by electricity, owing to the fact that, according to our calculations, much power could be saved in transmission and our machines could be made more efficient and more easy to control, and there would be less working loss in our business owing to the decrease in the liability of damage to our working stock from the effects of the dirt thrown from shafting, belts, pulleys, etc."

Establishment I—Capacity of electrical power plant, 193 horse-power. Product heavy and bulky. "We have no data on this subject for comparison."

Establishment K—Capacity of electrical power plant, 185 horse-power. Product bulky. "The comparative saving in the changes we have made in substituting electrical machinery for shafting and belt transmission is about 33⅓ per cent in fuel."

Establishment L—Capacity of electrical power plant, 150 horse-power. Product easily handled, but cleanliness of importance. "Our plant is not entirely electrical, being rather a combination with transmission by belting and shafting. We have, however, thoroughly convinced ourselves of the economy of an electrical plant, and were it not for the very large investment involved to make a complete change, should not hesitate to to do so, and, were we constructing an entirely new plant, should certainly make it electrical throughout."

Establishment M—Capacity of electrical power plant, 100 horse-power. "Have not been able to make complete tests." And further, "We contemplate in future changing more entirely to electrical power. At present a little over half is covered in this way."

Establishment N—Product easily handled, but cleanliness of importance. "Our works are so constructed, and so run, with a mixture of various industries, which makes it impossible for us to know anything about these matters more than this—we find the use of generators and motors for certain parts of our power transmission so much handier, neater, cleaner and more desirable, that even if it were not economical from the standpoint of fuel economy, we would certainly desire it in preference to line shafting and belting."

Establishment O—Capacity of electrical power plant, 55.5 horse-power. Product easily handled. "We do not think there is any question but that it is more expensive in the matter of fuel to run the works by electricity than it would be by direct power from the engine."

3 and 4. *Annual Expense for Repairs, and Frequency and Extent of Failures*—I have now given you the experience in regard to the comparative cost of fuel and attendance of fourteen establishments covering a wide range of industries, from iron mills and locomotive works to spinning mills and manufacturing pharmacists. The experience of the same establishments upon the relative expense for repairs upon electrical and mechanical transmission, and the relative extent and duration of breakdowns occurring with the two systems of transmission, is equally remarkable.

A—"The repairs to motors is much less than that formerly made to belts and line shafting. We have had no trouble whatever from breakdowns worth mentioning in either system."

B—The quotation already given covers these points.

C—No comparative information.

D—Covered in general under quotation previously given.

E—Apparently no great difference.

F—Covered in general under quotation previously given.

G—Repairs "75 per cent less since using electricity." "We have never had but one breakdown since running our electrical plant. * * * The armature of one of our small motors got full of water and burned out. This is the only accident or breakdown we have had."

H—"The comparative cost of repairs is much less in electrical transmission than in mechanical." "We have suffered no loss of time from this cause (breakdowns) during five years' experience with electric motors, with the exception of two instances, where armatures were burned out. We now keep duplicate armatures and there is no loss of time, as a new one immediately replaces the one damaged."

I—No comparative information.

K—"The cost of repairs is in favor of electric transmission, it being about 25 per cent cheaper. Comparing breakdowns of the old system with those of the electrical, a breakdown in the old method (mechanical transmission) always means the shutting down of a whole building, or at least a whole compartment in that building, while with the electrical method it means only one machine, or, at furthest, only a group of machines."

L—"In our case we should not say that the cost of repairs is any less for an electrical plant than otherwise, for the reason that we have such an extensive installation as to require the services of an electrician, whose salary is probably something more than we would have to pay for repairs on some other basis." (Electrician also cares for lighting plant.) "Through having made our installation from specifications and contracts drawn up by an extremely competent electrical engineer, and also being fortunate in having very competent men in charge of our entire steam plant, we have never had a breakdown in either system."

M—"Cost of repairs has been smaller than we anticipated. Have had but little trouble from breakdowns."

N—No comparative information.

O—"We are under the impression that there is more expense in keeping these motors in repair than there would be with direct power."

Summing up the general opinion in manufacturing establishments which are using electric power, it is safe to say that there is an overwhelming feeling in favor of the use of electrical transmission in preference to the various forms of mechanical transmission on the combined score of economy of operation and a reduced annoyance and expense through delays caused by failure of transmission apparatus.

This statement is based upon information given me, directly or through correspondence, by a very considerable number of establishments. The quotations entered above are taken from my correspondence, my choice of letters from which to make quotations being determined by the extent of the electrical experience upon which information given me was founded, and the fullness of the information. Few establishments have records from which comparative figures can be obtained, and those which have such figures are seldom willing to have them publicly quoted, but the quotations above show in a general way the results which have been obtained. Every one of the 14 firms from whose experience I have quoted may be said to be what the Germans would call *Welt Firma*. In nearly every case for which I have exact figures a sufficient direct saving is shown to be effected by the electrical transmission to make large returns on its greater first cost.

5 and 6. *Convenience*—I will now make a few quotations showing the general effect of electrical power on the convenience of handling product in the shop and its effect upon the output of the shop in the establishments already noted.

A—"We find that we can get a considerably larger amount of product out of a given amount of machinery when it is driven by electric transmission, in addition to the time saved in changing work where overhead machinery can be employed, which was impossible when belting was used." And again, "We are well pleased with our electric transmission and find the economy exists in our being able to transfer the work by overhead cranes—no belts interfering—the consequent amassing of the tools, economy of shop room, avoidance of delays to all the machinery at one time, ease of connections to auxiliary power; in fact, we do not see how we could do business without it. Its use is growing upon us to such an extent that we find it difficult to hold it in check enough to enable us to move cautiously in the matter."

B—See previous quotation.

C—"We do not consider that this method of transmission of power adds at all to the convenience of our workmen, or to the convenience in handling material in our factory, except that in case of breakdown in any part of the factory—that is, any difficulty to the line shafting or any tool or motor—by the use of electrical transmission of power it does not affect any other part of our factory; or if we are desirous of operating one department and not all, we can do so very easily by simply starting the necessary motors, and are therefore not obliged to drive unnecessarily a

long line shaft, nor operate any tools other than those that we wish to."

D—See previous quotation.

E—See previous quotation.

F—"We have made no comparative tests to determine whether or not we were saving any money by this system of distribution, it being largely with us a matter of convenience as at present operated."

G—Increased output.

H—See earlier quotations. Also: "In response to your inquiry, would say that most certainly the driving of our machinery by electricity adds to the convenience of our workmen, inasmuch as it gives them easy and perfect control of the machines. We are driving our machinery somewhat faster with electricity as the motive power than we formerly did when we used mechanical transmission, for the reason that we have quicker control of the machines. We thus expect to increase the product. We might also add that we also expect, although we have not run enough to demonstrate this point, that we shall largely reduce the percentage of second quality of goods produced by our machines."

I—"I am decidedly of the opinion that a shop can be equipped with electrical transmission in such a way as to increase its product very largely over any other mode. I am equally certain that, without the electrical transmission that we have in use in our shop, we could not do within 50 per cent of what we are now able to do."

K—"We have not changed our entire factory into the use of electric equipment but whenever it is necessary to make any changes we invariably drop the old and put in the new idea."

L—"We see no reason why electric driven machinery should show any advantage in the way of convenience over any other system, provided construction is good. So far as the output of our factory is concerned, we do not think it is affected either one way or the other by the system employed." (Compare quotation for establishment L under economy.)

M—"We contemplate in future changing more entirely to electric power. At present a little over one-half is covered in this way."

N—"* * * We find the use of generators and motors for certain parts of our power transmission so much handier, neater, cleaner and more desirable, that, even though it were not economical from the standpoint of fuel economy, we would certainly desire it in preference to line shafting and belting."

O—Apparently no advantage.

Summing up, as before, it is the nearly universal experience that in establishments turning out a product of bulky or heavy articles the electrical equipment adds materially to the shop efficiency, a result which seems to be principally due to the convenience which it lends to the arrangement of tools and handling the work from overhead; this not only saves time in itself, but it also leads the workmen to give better service. In establishments where the product is in small articles and articles which must be handled in a fixed manner, and where cleanliness is important, the electrical equipment adds to the shop efficiency more largely through cleanliness. This may be a matter of much importance, but ordinarily it is less important than is the question of convenience to the manufacturer of heavy or bulky articles. The floor space, which can be saved by the use of electrical transmission through a better arrangement of machinery, is also much greater in the case of establishments turning out bulky or heavy articles.

7. *Safety*—The superior position of the electrical transmission with respect to the safety of workmen is evident, and it is not advisable to prolong this paper by entering into a discussion of it here. In regard to the question of fire risk, it is general experience that an electrical plant properly installed is perfectly safe.

(To be concluded.)

National Association of Manufacturers.

The second annual convention of the National Association of Manufacturers will be held in Philadelphia on January 26, 27 and 28, 1897 (Tuesday, Wednesday and Thursday). The large membership of the association, the importance of the many matters which will be considered by the convention, and the extensive arrangements for the entertainment and comfort of the visitors which have been made by the people of Philadelphia, all promise to make this not only the most important meeting of the association, but also one of the most notable gatherings of American manufacturers that has ever taken place. The association has a membership of about 800 of the most prominent manufacturers in the United States, representing a wide range of industries, and a large proportion of these members will attend the convention. In order to give to the work of this convention the largest possible effect, a general invitation to attend the sessions has been extended to all manufacturers, and this will swell the attendance to large proportions.

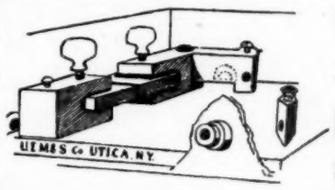
The business sessions of the convention will be held in the new Horticultural Hall, on Broad street, below Locust, and the headquarters of the association during the convention will be in the Hotel Walton, directly opposite the place of meeting. Horticultural Hall is within a few minutes' walk of the Pennsylvania and Philadelphia & Reading Railroad terminals, and within two squares of the convention hall on Broad street there are five hotels, with unexcelled accommodations, for those who attend the convention.

Harrison Telephone Company.

At Chicago, on January 15, the bill for a receiver for the Harrison International Telephone Company was ordered by the court to be amended.

Armorite Interior Conduit.

Mr. James F. Cummings, general manager of the Armorite Interior Conduit Company, of Detroit, informs the ELECTRICAL REVIEW that his company has issued a new reduced price-list of Armorite conduit and fittings. Business is booming with the company, as it has on hand several good-sized contracts and more in sight.



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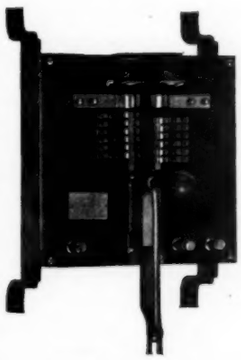

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ADVANCE INFORMATION

Electric Light and Power.

DEMOPOLIS, ALA.—The Demopolis Electric Light and Power Company has been incorporated by R. P. Knox, F. E. Semon, J. G. K. Williams and L. W. Spaulding. Capital stock, $7,000.

MARINETTE, WIS.—C. B. Pride may give information concerning contemplated erection of electric light plant.

DETROIT, MICH.—Regent Levi L. Barbour is interested in proposed erection of electric light plant.

SIDNEY, N. Y.—The work on electric light plant is being rapidly pushed to completion.

FAIRMONT, MINN.—The electric light plant was destroyed by fire; fully insured.

NEW YORK CITY.—A new electrical plant is to be placed in the new Waldorf Hotel on Fifth avenue, New York, owned by John Jacob Astor.

BENWOOD, W. VA.—The Baltimore & Ohio Railroad Company proposes extensive improvements at Benwood, including the erection of a large electric lighting plant.

IRONTON, OHIO—The Ironton Door Factory will establish an electric light plant at its factory.

BLUFFTON, OHIO—City Clerk may give information concerning proposed electric light plant.

CAMBRIDGE, OHIO—A new electric light plant is to be erected by the city, which is not to exceed $18,000.

GREENVILLE, PA.—The Electric Light, Heat and Power Company will enlarge their plant in order to give better service.

BRATTLEBORO, VT.—An electric power plant is to be constructed for generating electricity for power for the various manufacturing industries of Brattleboro.

CULPEPPER, VA.—Jeffries Brothers will commence the construction of an electric light plant.

MONTICELLO, ARK.—Mayor may be addressed concerning construction of electric light plant.

PITTSBURG, TEX.—An electric light plant will probably be established.

HAGERSTOWN, MD.—The electric light plant is to be enlarged.

NEW BRIGHTON, PA.—A move is on foot for the erection by the borough of an electric light plant. The proposed new plant would be for 100 lamps of 1,200 candle-power, and it is estimated it could be built for $20,000.

SMITHVILLE, TEX.—Electric lights are to be established here next month.

NEW YORK, N. Y.—John Jacob Astor has just concluded a contract with the Walker company for a great electric plant for the new Waldorf Hotel on Fifth avenue. Among those principally interested in the company is James W. Hinkley. Ex-Governor Flower and Perry Belmont also have large interest in the company.

LIMA, OHIO—The County Commissioners have let the contract for the putting in of an electric light plant for furnishing the court-house, jail and sheriff's residence with light. The engine and dynamo will be placed in the basement of the court building, and the entire plant will cost $2,460.

BRUNSWICK, GA.—The Oglethrope Hotel building will be equipped with an electric light plant.

TABLE GROVE, ILL.—The Table Grove Milling Company will establish an electric light plant if the Village Board of Trustees will order six more arc lights of 1,600 candle-power for street illumination.

HOLYOKE, MASS.—Alderman Gervals may be addressed concerning establishment of a municipal lighting plant.

SCRANTON, PA.—Edwin G. Hughes, contractor, can give information concerning establishment of electric lighting plant.

BOILING SPRINGS, PA.—The Carlisle Electric Light, Heat and Power Company; work on new plant commenced January 1. Heavy cables will convey the electricity to Carlisle.

BREWER, ME.—The Brewer Light and Power Company has been incorporated, with a capital stock of $100,000. The officers and promoters of the company are: President, Hon. F. H. Nickerson; treasurer, J. N. V. Lane; secretary, J. C. Holbrook.

ADAIRVILLE, KY.—Electric lights are to be established here.

MONTGOMERY, MINN.—The J. Quirk Milling Company made a contract with the D. and D. Manufacturing Company to put in an electric plant to light this village. A 650-light dynamo will be used to furnish the current, and the plant is to be in operation by the first of February.

COLD SPRING, N. Y.—A plan for lighting this village with electricity is being discussed.

CAZENOVIA, N. Y.—Electric lights are to be established here.

BAINBRIDGE, GA.—Sig Nussbaum will construct an electric light plant. A 35 to 50-arc and 500 to 750-incandescent system will be established.

PEORIA, ILL.—W. H. Becker, it is stated, will put in a complete electric plant of his own.

BYRON, MICH.—An electric light plant is to be established.

CAVENDISH, VT.—E. G. White is interested in the establishment of an electric light plant.

WHARTON, TEX.—An electric light plant is to be established.

LEBANON, IND.—City Clerk may be addressed concerning electric light plant.

MEDFORD, MASS.—City Clerk Joyce may be addressed concerning establishment of electric light plant.

NEW ALBANY, IND.—The English Electric Light Company has sold its plant and franchise to W. H. Keller, of Corydon.

WOODSTOCK, VA.—L. W. Brown may be addressed concerning erection of electric light plant.

HEMPSTEAD, TEX.—Emmet A. Ellis will erect an electric light plant.

DES MOINES, IOWA—Frank B. Rae, of Chicago, has arranged with the City Council to prepare plans for an electric light plant.

New Telephone and Telegraph Companies.

MARCUS, WASH.—Eureka Telegraph and Telephone Company has been incorporated by Julius Pohle, Sigamour Dielsheimer, Julius Ehrich, Charles Luft and Josef Pohle. Capital stock, $500,000.

ELBERTON, GA.—Arrangements have been completed for connecting this place with Athens, Atlanta and Harmony Grove by a long-distance telephone at an early date.

AURORA, MO.—A telephone line is being built from this place to Madden and McDowell in Barry County.

UPPER SANDUSKY, OHIO—The Upper Sandusky Telephone Company has been incorporated with a capital stock of $12,000.

EXCELSIOR SPRINGS, MO.—A telephone exchange is to be established here.

GOLDEN, B. C.—There is a movement on foot to secure the construction of a telegraph line between this place and Fort Steele. The importance of Fort Steele as a mining district warrants the early commencement of this undertaking.

VAN WERT, OHIO—The Van Wert Home Telephone Company has been incorporated by G. M. Saltzgeber, H. Kewper, George W. Kohn, John Van Lien and W. H. Pennell. Capital, $25,000.

ADRIAN, MICH.—Wauseon, Ohio, capitalists will extend their telephone line to this place at once. The line will also connect the principal towns in northwestern Ohio and northern Indiana.

LONG CREEK, ORE.—A telephone line is to be built here soon.

TACOMA, WASH.—The Sunset Telephone Company will spend about $75,000 in improvement to their long-distance lines, beginning in the Spring, and building, among others, a new line over the Cascade Mountains, connecting this place with Spokane and eastern Washington.

PATERSON, N. J.—The Paterson Telephone Company has filed its certificate of incorporation in the County Clerk's office. The incorporators are Charles F. Ludington, of Jersey City; William H. Chamberlain, of Delano, and Clarence W. Hughes, of Brooklyn, N. Y. The capital stock is $300,000.

New Electric Railways.

RACINE, WIS.—The Milwaukee, Racine & Kenosha Railway Company has been incorporated to build and operate an electric street railway system from South Milwaukee to the city of Kenosha. Capital stock, $250,000.

KANSAS CITY, MO.—Northeast Electric Railway Company has been incorporated by Bayliss Steele, of Kansas City; R. R. Conklin and S. M. Jarvis, to build and maintain a railway.

CINCINNATI, OHIO—The Cincinnati, Hamilton & Dayton Traction Company has been incorporated. The capital stock of the new company, which will build and operate all of the proposed rapid transit lines in connection with the Cincinnati, Hamilton & Dayton service, is $50,000. The incorporators of the new company are D. G. Edwards, C. G. Waldo, George R. Balch, R. P. Rifenberick and C. A. Wilson.

SOUTH FRAMINGHAM, MASS.—A movement is on foot for the organization of a corporation to build a trolley line to Sherborn and Medford.

YOUNGSTOWN, OHIO—The project of an electric road to Hubbard is again being agitated, and it is said that this time the Youngstown Street Railway Company is back of the movement.

BRIDGEPORT, CT.—A party of gentlemen, representing a syndicate of capitalists, are considering the advisability of constructing a trolley road from this place to Phœnixville and thence to Pottstown.

New Manufacturing Companies.

NEW YORK, N. Y.—Vice Versa Electric Lamp Company has been incorporated by Joseph Worth, Maurice B. Hayman and George W. Gorton. Capital stock, $5,000.

ST. LOUIS, MO.—The Electric Push Button Manufacturing Company has been incorporated by Anthony Silverston and others. Capital stock, $50,000.

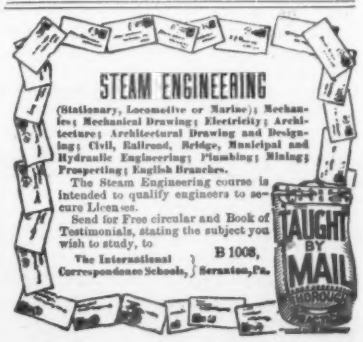
GLOUCESTER, N. J.—The Electric Portable Lamp Company has been incorporated to manufacture portable electric lamps. The capital stock is $50,000.

CASTLETON, N. Y.—The New York & Staten Island Electric Company has been incorporated to manufacture electricity for producing light, heat and power. The capital is $500,000 and the directors are John B. Summerfield and De Witt V. D. Bailey, of Brooklyn; Samuel B. Lawrence, Francis P. Lowery and Charles L. Horton, of New York city.

CLEVELAND, OHIO—The Dubrow Incandescent Company has been incorporated by John H. Dubrow, Arnold C. Saunders, Andrew Squire, E. M. Folsom and W. U. Maiters. Capital stock, $30,000.

Increase of Capital.

PITTSBURGH, PA.—The Electric Gas Light, Heat and Power Company will increase its capital stock from $50,000 to $1,000,000, and will erect a machine shop in some suburban town immediately.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Kindred.... ...Interests

The E. W. Bliss Company, Brooklyn, N. Y., manufacturers of presses, shears, dies and special machinery for making armature disks and heavy machinery, speak of an unusually heavy demand for mechanical equipments in foreign countries.

G. A. Frei & Company, 17 Bromfield street, Boston, makers of X-ray supplies and physical apparatus, will be succeeded by the Swett & Lewis company, and will hereafter be known by that name. Mr. G. A. Frei, who has for many years been identified with scientific matters, retires from the company.

The "Wright demand meter," which was illustrated and described in these columns, is now being tested by a number of electrical companies, and Mr. R. S. Hale, the owner, said that the results of the tests so far were most encouraging as to the practical importance of such an instrument for universal use.

The Contract for the complete rolling stock of the Quebec Electric Railway, including cars, motors, etc., has been awarded to Ahearn & Soper, of Ottawa. The system at Quebec will be as nearly as possible a duplicate of that at Ottawa, which is recognized as a model. The motors used will be of Westinghouse make and will be specially adapted for the grades which exist at Quebec.

The Paragon Arc Lamp Company, of Boston, are just arranging to establish a western branch, and Mr. F. B. Smith, of the company, is en route to Chicago to superintend arrangements relative to the extension of the business. The Paragon company are introducing to the electrical field a new design of series circuit and alternating circuit arc lamps, also open and long-burning lamps for constant-potential circuits.

One of the factories at Lynn belonging to the Consolidated Insulated Tube Company, of Boston and Lynn, manufacturers of interior and underground conduit, was recently damaged by fire so much that it will mean some weeks before the plant is re-established. Mr. George F. Virtue, the secretary of the company, mentioned to a representative of the ELECTRICAL REVIEW that the company were about to increase the plant by the addition of considerable special machinery.

After considerable difficulty in finding a proper building, the Lynn Incandescent Lamp Company is soon to open a very much larger establishment for the renewal of incandescent lamps. This company has been in existence some months, and the business has increased so rapidly that, as Mr. E. F. Dwyer, the general manager of this company, says, the method of redeeming incandescent lamps by its method has become an important element to users of incandescent light.

The demand for X-ray apparatus, particularly the high-frequency Tesla coils made by the L. E. Knott Apparatus Company, of Boston, is an excellent testimonial of the splendid construction and the scientific methods involved in this form of coil. The company has also furnished a very large number of hospitals and physicians with complete installations for X-ray research, and is making it a prominent feature in its business as manufacturer of physical and scientific equipments. The Knott company has devoted careful study to the question of the forms of Crookes tubes, and for this work possesses excellent facilities, inasmuch as the company maintains its own glass-blowing establishment.

Thos. J. Fay and Associates, New York agents and general exporters for the Crocker-Wheeler Electric Company, 143 Liberty street, New York, have been awarded the contract for the ventilating motors to be used in Mr. John Jacob Astor's new hotel, comprising as follows: Two 24-horse-power motors, maximum speed, 190 revolutions per minute; one 30-horse-power motor, maximum speed, 140 revolutions per minute; one 32-horse-power motor, maximum speed, 175 revolutions per minute; one 40-horse-power motor, maximum speed, 115 revolutions per minute; one 60-horse-power motor, maximum speed, 175 revolutions per minute; one 90-horse-power motor, maximum speed, 140 revolutions per minute. These motors will be direct-connected to exhausters and blowers, and the plant is probably the largest and most complete electrical equipment for ventilating work for which a contract has ever been let.

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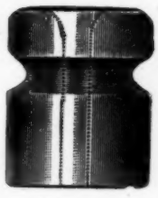

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Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED JANUARY 12, 1897.

574,885 Controller for electric motors; H. P. Davis, Pittsburgh, Pa.—A plurality of circumferentially located contact pieces arranged in groups or sets, varying in width, whereby the number of circuit changes is increased.

574,889 Electric cigar-lighter; J. W. Dawson, Louisville, Ky.—A cigar-cutting apparatus with an incandescent lamp, an incandescent cigar-lighting device, an advertising case and a switch, the parts connected so that by the movement of the handle the lamp and the lighting device are energized and the cutter operated.

574,896 Combined rheostat and reversing switch; J. P. Fiske, Alliance, Ohio.

574,901 Telephone; C. C. Gould, Philadelphia, Pa.—A diaphragm and a rolling electrode, a basket comprising a plate and a series of arms projecting outward from said plate for the accommodation of said rolling electrode.

574,903 Electric meter; J. Hessberger, Niederseidletz, Germany.—Comprises a bismuth or bismuth-alloy conductor arranged in circuit and a second conductor in circuit and producing a magnetic field, one of said conductors being movable in relation to the other.

574,905 Electric arc lamp; R. O. Hood, Danvers, Mass.

574,914 Means for adjusting compound-wound dynamos; B. G. Lamme, Pittsburgh, Pa.—The method of adjusting the compounding of series coil of a compound-wound dynamo, which consists in varying its compounding effect, while maintaining a constant resistance between its terminals.

574,954 Electric signal; R. Skeen, Madison, Ill.—Consists of crossing tracks and an electric conductor extending along one track for supplying electricity as a motive power, means under the control of a train moving along the other track for temporarily cutting the electricity off from a portion of said conductor along the first-named track, and a locking device to lock said means throughout the duration of said temporary cut-out.

574,965 Vacuum dispatch system; J. A. Watson, Washington, D. C.—The combination of a normally closed and exhausted tube, a carrier movable within the tube, and exhausting mechanism to constantly maintain a vacuum within the tube.

574,978 System of lightning protection for electric circuits; A. Wurts, Pittsburgh, Pa.—A source of current and translating devices, a line circuit provided at suitable intervals with ungrounded inductive resistances, said resistances serving to dissipate static charges by transforming their energy into heat.

574,979 Device for protecting electric circuits; A. J. Wurts, Pittsburgh, Pa.—A choke coil provided with a conducting piece or strip adjacent to several of the turns thereof, and a slotted insulating strip interposed between said conducting strip and said turns, in combination with a lightning arrester interposed between said conducting-strip and the ground.

574,994 Printing telegraph; B. Hoffman, Paris, France.

575,002 Illuminant for incandescent lamps; A. de Lodyguine, Pittsburgh, Pa.—Composed of an incandescing metallic body and containing a conducting fillet of different material.

575,045 Electric valve apparatus; J. V. Stout, Easton, Pa.

575,047 Electric quick-break switch; A. H. Armen, Philadelphia, Pa.

575,053 Electric railway; L. Dion, Natick, Mass.

575,054 Electrical propulsion for railway cars; L. Dion, Natick, Mass.—A closed conduit, a helical, flexible, auxiliary electrical conductor therein, with a main electrical conductor having a concaved groove along its upper surface.

575,059 Bicycle bell; H. B. Ewbank, Baltimore, Md.

575,093 Automatic electric marine sounding apparatus; J. F. Babcock, Bangor, Me.

575,115 Manufacture of castings; A. E. Hunt, Pittsburgh, Pa.—Consists in heating the same by first passing a current of electricity through the conductive material of the mold and through the entire length of the mold, and then progressively shortening the portion included in the electrical circuit.

575,116 Direct-current dynamo-electric machine; M. Hutin, Paris, France.

575,131 Signaling appliance for telephone switchboards; C. E. Scribner, Chicago, Ill.

575,156 Electric bell; J. W. Holdsworth, St. Louis, Mo.

575,170 Electric conductor; H. T. Richards, Brooklyn, N. Y.—An insulated conductor provided with a marker occurring at periodic intervals throughout its length and projecting from the surface by which its identity may be recognized.

575,176 Dynamometer; L. Schuler, Goppingen, Germany; Two disks, two tappets on one disk, the spring-arms carried by the other disk and engaging the tappets, the indicator and the system of levers for operating the same and the projection for operating said lever system.

475,186 Telephone system; J. H. Weckel, Breakabeen, N. Y.—Consists of a main line, including in its circuit a plurality of stations each having a transmitting and receiving apparatus and a signal, a central office normally in the circuit of the main line through the medium of a switchboard, a supplemental signal at the central office connected with the switchboard, and one or more side lines normally in circuit with said signal through the medium of the switchboard, said switchboard being adapted to throw the side line into circuit with one section of the main line, and at the same time to throw the remainder of the main line into circuit with the supplemental signal.

575,210 Dynamo-electric machine; G. L. Campbell, Kinsman, Ohio—Consists of an armature, supports movable toward and from the armature, field magnets pivotally carried by said supports, and means for holding the field magnets in position.

575,235 Electric current regulator; W. Hawker, Windsor Mills, Canada.

575,303 Electric railway; G. W. C. Lomb, Birmingham, Ala.

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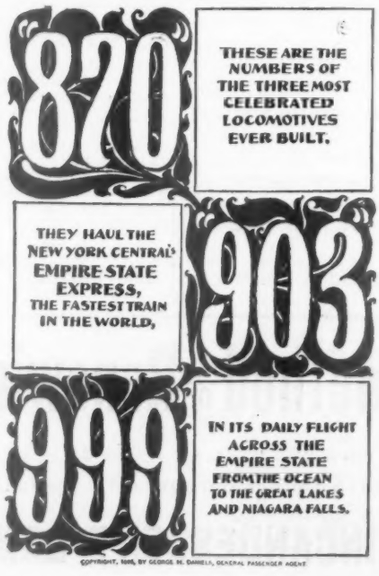
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